Operation and Maintenance Report
January 2019 to December 2019

McCormick and Baxter Superfund Site

Portland, Oregon
ECSI Site No. 74

Prepared for
Oregon Department of Environmental Quality

July 22, 2020
150-002-005/Task 3

HARTCROWSER

GSI Water Solutions, Inc.

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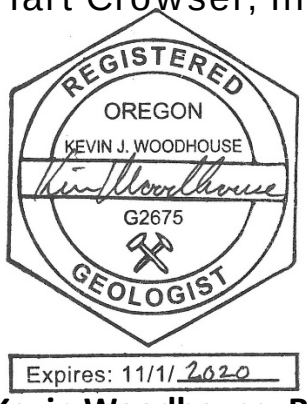

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Acronyms and Abbreviations

ACB	articulated concrete block
AWQC	ambient water quality criteria
BEI	Bravo Environmental, Inc.
bgs	below the ground surface
BES	City of Portland, Bureau of Environmental Services
DEQ	Oregon Department of Environmental Quality
DNAPL	dense non-aqueous phase liquid
EPA	U.S. Environmental Protection Agency
ft/ft	foot per foot
FWDA	Former Waste Disposal Area
GSI	GSI Water Solutions, Inc.
ICs	institutional controls
IGA	Intergovernmental Agreement
LNAPL	light non-aqueous phase liquid
Metro	Metro Regional Government
mg/kg	milligrams per kilogram
NAPL	non-aqueous phase liquid
NAVD88	North American Vertical Datum of 1988
NOAA	National Oceanic and Atmospheric Administration
ng/L	nanograms per liter
O&M	Operation and Maintenance
PAHs	polycyclic aromatic hydrocarbons
PCP	pentachlorophenol
PFR	Portland Fire and Rescue
PVC	polyvinyl chloride
RCRA	Resource Conservation and Recovery Act
RM	River Mile
ROD	Record of Decision
site	McCormick and Baxter Superfund site
TEQ	toxic equivalency
TFA	Tank Farm Area
TRM	turf-reinforced matting
µg/L	micrograms per liter
USGS	U.S. Geological Survey
WCI	Westlake Consultants, Inc.

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Portland, Oregon

1.0 INTRODUCTION AND PURPOSE

This Operation and Maintenance (O&M) Report has been prepared for the Oregon Department of Environmental Quality (DEQ) to document the O&M activities implemented at the McCormick and Baxter Superfund Site (site) located in Portland, Oregon, between January 1, 2019, and December 31, 2019.

O&M activities are identified in the Final O&M Plan prepared by the DEQ and the U.S. Environmental Protection Agency (EPA) (DEQ and EPA 2014). The Final O&M Plan defines the administrative, financial, and technical details and requirements for inspecting, operating, and maintaining the remedial actions at the site. DEQ and EPA reduced the scope and frequency of O&M activities conducted at the site in 2010, from the frequency conducted at the site from 2005 through 2010. The Final O&M Plan reflects that reduction. The O&M Manual specifies the sampling and monitoring procedures, quality assurance and quality control, technical information, and data necessary for implementing O&M activities. The O&M Manual is a living document that is modified periodically to reflect necessary monitoring and maintenance needs at the site. Hart Crowser, Inc., and GSI Water Solutions, Inc. (GSI) recently updated the O&M Manual in March 2018 (Hart Crowser and GSI 2018).

The purpose of this O&M Report is to document the operation, monitoring, and maintenance activities that occurred in calendar year 2019. Figure 1-1 shows the location of the site; Figure 1-2 presents the site layout and features; Figure 1-3 presents the site capping components; Figure 1-4 presents the site layout with surface elevations; Figure 1-5 presents the historical contaminant areas; and Figure 1-6 presents historical non-aqueous phase liquid (NAPL) distribution. This report has been prepared by DEQ's contractor team, Hart Crowser and GSI.

The O&M performance standards and activities for the soil cap and sediment cap are discussed in Sections 2 and 3, respectively. The groundwater performance standards and activities are summarized in Section 4. Vegetation management is presented in Section 5. Section 6 discusses the remedy performance, and Section 7 presents recommendations for 2020. Section 8 provides references. Appendix A provides a photograph log of site activities and observations associated with O&M activities. Appendix B provides site activity documentation, including the field observation forms for the soil and sediment cap, status meeting summaries, and the sign-in log. Appendix C provides a photograph log for vegetation observations.

Routine operation, monitoring, and maintenance activities in 2019 were implemented primarily by DEQ's contractor, Hart Crowser, and its teaming partner GSI (under subcontract to Hart Crowser). O&M activities were also performed by Amaral Nursery, Inc.; American Backflow Services; Bravo Environmental, Inc. (BEI); and Westlake Consultants, Inc (WCI).

Key personnel for implementation of O&M activities include:

- Sarah Miller: DEQ Project Officer
- Danielle Johnson: DEQ Contract Officer
- Rick Ernst: Hart Crowser Program Manager
- Kevin Woodhouse: Hart Crowser Site Manager
- Kaylan Smyth: Hart Crowser Former Site Manager
- Andrew Davidson: GSI Hydrogeology Manager
- Erin Carroll Hughes: GSI Former Hydrogeology Manager

2.0 SOIL CAP PERFORMANCE STANDARDS AND ACTIVITIES

This section presents a summary of soil cap performance standards, observations, and maintenance activities at the site for the reporting period January 1, 2019, through December 31, 2019, and a summary of remedy performance as related to the performance standards. The Final O&M Plan provides a description of the remedial action objectives and the soil operable unit remedy. Table 2-1 provides the soil cap activities conducted in 2019.

2.1 Soil Cap Performance Standards

Contaminated soil was removed, and an upland soil cap was constructed on approximately 41 acres of the site in September 2005. Institutional controls (ICs) have not been completed for this portion of the site. Soil beneath the soil cap remains contaminated with arsenic, pentachlorophenol (PCP), polycyclic aromatic hydrocarbons (PAHs), dioxins/furans, and NAPL and as such, the soil cap requires long-term monitoring and maintenance. The performance standards for the soil cap are as follows:

- Maintain contaminant concentrations in surface soil below the following risk-based cleanup goals, as specified in the Record of Decision (ROD) (EPA 1996):
  - Arsenic: 8 milligrams per kilogram (mg/kg)
  - PCP: 50 mg/kg
  - Total carcinogenic PAHs: 1 mg/kg
  - Dioxins/furans: 0.00004 mg/kg
- Maintain the topsoil layer to within 50 percent of its design specification as follows:
  - Maintain a topsoil thickness of at least 6 inches for the area over the impermeable geomembrane cap.
  - Maintain a topsoil thickness of at least 12 inches for all areas except over the impermeable geomembrane cap.
- Minimize infiltration of rainwater within the subsurface barrier wall by maintaining the subsurface stormwater conveyance system.
- Minimize stormwater erosion and ponding outside the barrier wall by maintaining site grading, surface stormwater conveyance, and native vegetation.

- Maintain native vegetation within the 6-acre riparian zone for compliance with the National Marine Fisheries Service Biological Opinion (National Oceanic and Atmospheric Administration [NOAA] 2004).

2.2 Soil Cap Observations

Soil cap observations were conducted according to the Final O&M Plan. Routine quarterly site inspections were conducted on February 7, April 3, July 18, and October 16, 2019, by DEQ, Hart Crowser, and GSI. These inspections are documented on observation forms developed for the site. Supporting documentation and pertinent details are included in Appendix B. Observations of interest from the routine inspections are summarized on Figure 2-1 and described below. Representative site photographs taken in 2019 are presented in Appendix A. As required for the site administrative record, a log of all site visitors in 2019 was kept and is also included in Appendix B.

2.2.1 Visual Inspection

The upland soil cap provides habitat for rabbits, ground squirrels, Canada geese, several other species of birds, and coyotes. Despite placing gravel to fill gaps under the fence around the upland portion of the site, periodic burrowing continues to be observed under the fence and along the perimeter road. These burrows are filled as necessary (Appendix A, Photograph A11) and are not of major concern. Burrows were observed and filled more frequently in the first half of 2019, and sporadically during the second half of the year.

Evidence of ground squirrel activity was observed at several locations throughout the upland soil cap. Ground squirrels are common to the area, and their burrows typically extend to approximately 1 foot below the ground surface (bgs). The ground squirrels use the surplus articulated concrete block (ACB) stockpiled at the site, paved roadway, and concrete well monuments as habitat. Observed burrows were generally less than 6 inches deep and did not require repairs. The soil cap continues to isolate site contaminants from human and ecological receptors. Continued monitoring of the burrows will be performed; however, no action to remove burrowing animals or to fill in the burrows is planned or necessary at this time.

Coyotes were observed roaming on the soil cap during the February 2019 quarterly site inspection. Goose scat observed throughout the soil cap indicates that geese periodically visit the site, though they were not directly observed during site visits.

On September 24, 2018, a fire burned approximately 1 acre of grass at the northeast side of the site on the earthen soil cap. The fire burned an approximate 600-foot-long area between the gravel road and the northern perimeter fence. Evidence of the fire (e.g., charred or reduced grass coverage) was still observable during the February and April 2019 quarterly site inspections (Appendix A, Photograph A5). Following the spring rain season, grass coverage in the burned area had returned and no signs of fire were observable during the July 2019 quarterly site inspection.

The gate at the top of North Edgewater Road marks the entrance to the site and Willamette Cove property. This gate, which is locked with a series of locks and a chain, provides access for two railroads, Northwest Natural Gas, Metro Regional Government (Metro), DEQ, and other agencies. Locks for one or

more of the various agencies were found to be cut or excluded from the lock series in September and November 2019 and were subsequently replaced by Metro.

The Union Pacific Railroad tracks, which run parallel to the northwest of the site and neighboring properties, are often used by the public to access the area. Access to the area generally does not affect security because of the surrounding fence and lighting at the site but periodic acts of trespassing or vandalism occur. Upon arrival at the site for the February 7, 2019, quarterly site inspection, the lock on the gate to the paved storage building area was missing; it was replaced by Hart Crowser. During the inspection, it was also identified that the lock on the southeastern gate had also been cut by the Portland Fire and Rescue (PFR) and was replaced with a PFR lock.

On August 21, 2019, the storage container on the northern side of the storage building was observed to have open doors and a cut lock laying in front of it. It was not apparent if the cut lock was a recent occurrence. The storage container housed old equipment and miscellaneous items and did not appear to have anything taken. The storage container was re-secured with a new lock.

2.2.2 Soil Cap Subsidence

In June 2008, subsidence of the soil cap was observed near groundwater monitoring wells EW-1s and MW-23d. An upland site survey confirmed that the ground surface had subsided approximately 1 foot in a limited area around the wells between the time that the soil cap was installed in 2005 and 2008. A Subsidence in Upland Cap Memorandum (Hart Crowser and GSI 2008) and an Additional Subsidence Monitoring Memorandum (Hart Crowser and GSI 2010) present the results of the survey and additional investigation to determine the cause of the subsidence.

Based on elevated groundwater temperatures in well EW-1s (40 °C) and the large amount of buried woody debris in the area, it was suspected that aerobic degradation of woody debris was occurring and causing the ground surface subsidence. Decreasing groundwater levels within the barrier wall also may have contributed by opening a larger unsaturated zone that allows compaction. In 2009, the shallow well EW-1s was sealed to reduce the amount of oxygen reaching the unsaturated zone. After the well was sealed, subsidence slowed with no additional subsidence being observed over the past 10 years. The groundwater temperature dropped to approximately 21 to 23°C and has remained stable for the past 10 years. Current temperatures in the well are approximately 19 to 20°C. This temperature is still higher than groundwater from surrounding wells (approximately 13°C) indicating that some heat is still being produced in the subsurface near well EW-1s. This may be caused by anaerobic degradation, which generates less heat than aerobic degradation.

Ground surface subsidence is monitored by measuring the inner polyvinyl chloride (PVC) casing at well MW-23d relative to the steel outer casing of the well. The inner casing extends to 182 feet bgs and is considered to be stable. The outer casing is representative of the ground surface and if the casing (or ground surface) subsides, then the distance between the inner and outer casing decreases. Since 2012, the distance has been measured at approximately 2.75 inches. Slight differences in the distance measured (within 0.10 inch for all events) are likely due to variability in measuring equipment and field personnel. Previously, the total decrease in distance between the inner and outer casing from December 2008 (first

periodic measurement conducted) to 2012 was approximately 1.35 inches, with most of the decrease occurring in 2009. Thus, approximately 1.35 inches of subsidence of the ground surface in this area has occurred subsequent to 2008.

Subsidence monitoring was performed in 2019 to evaluate the continued effectiveness of EW-1s well sealing activities and to determine if additional settling had occurred since 2009. A topographic survey and storm sewer video inspection were performed to collect data for this evaluation. Field activities and the monitoring evaluation results are discussed below and documented in further detail in the Technical Memorandum – Subsidence Monitoring and Evaluation (Hart Crowser 2019).

WCI performed a topographic survey and site feature survey between August 13 and 21, 2019, to collect survey data for comparison to site survey data collected in 2008. The topographic survey used a 25-foot grid spacing with additional resolution around EW-1s and MW-23d using a 10-foot grid spacing within a 60-foot by 60-foot area centered on those wells. Site features were also surveyed, including storm drain manholes and pipe inverts; fence lines; building and asphalt extents; and all monitoring wells (except for wells located on the Willamette Cove property [MW-7WC, MW-35r, MW-58d, MW-58i, and MW-58s] on the northern side of the Burlington Northern Railroad bridge). Subsequent to the site survey in 2008, the well elevations for EW-1s, MW-23d, and MW-50s were surveyed during subsidence monitoring events and the elevations were used for comparison to data collected for those wells in 2019.

The 2008 and 2019 topographic survey data were compared and identified a mix of slight subsidence between 0 to 0.5 feet and slight uplift between 0 to 0.5 feet throughout the site. Areas of greater subsidence were present around wells EW-1s and MW-23d, adjacent to manhole SDMH-E, between the perimeter road and perimeter fence along the southeastern boundary of the site, and along the upper edge of the ACB. The survey data comparison results are shown on Figure 2-2.

The storm sewer video inspection was performed to monitor for potential impacts to the storm drain line integrity from soil subsidence and to evaluate previously documented sags (Figure 1-4) in the pipe between manholes SDMH-B and SDMH-C. BEI performed the storm sewer video inspection on October 4, 2019, using a remote-operated crawler camera to inspect the line (Appendix A, Photograph A18). No new sags were identified during the video inspection, and no breaks, fractures, or cracks were identified.

While not anticipated, significant additional settling in this area could affect performance of the stormwater conveyance system. The stormwater conveyance system is observed quarterly and continues to perform as designed with steady flow from the outfall during and immediately after rainfall events.

2.3 Soil Cap Maintenance Activities

Routine maintenance activities performed at the site in 2019 included a monitoring well inspection, replacing locks, filling animal burrows, replacing gas vent covers, removing invasive shrub growth, and monitoring re-vegetation of the burned area at the northeast side of the site.

On March 25, 2019, Hart Crowser performed multiple O&M activities at the site. Soil cap maintenance included cutting down and removing a small tree northeast of MW-23d; filling in ruts adjacent to the gravel

road outside the perimeter fence along the riparian area; and replacement of a cut lock (Appendix A, Photograph A6) and repairs to the main gate shackle which had been bent by unauthorized site entry. During the site visit, it was identified that two gas vents, GV-1 and GV-4, were missing vault boxes (Appendix A, Photograph A7) and required additional supplies to implement repairs.

A vegetation inspection was performed on May 17, 2019, concurrently with O&M activities. The vegetation inspection results are described in detail in Section 5.3.2 and identified several noxious plant species in both the upland and riparian areas of the site. Replacement of the missing gas vent vaults for GV-1 and GV-4 was completed as part of the O&M activities (Appendix A, Photograph A12).

A pesticide application event was performed on June 5, 2019, to target the noxious species and is described in further detail in Section 5.4.1.

On September 12, 2019, American Backflow Services of Portland, Oregon, tested the site's water supply line backflow prevention valve. The backflow prevention valve met state regulation standards.

On November 1, 2019, Hart Crowser performed lock maintenance for gates in the storage building area. Combination lock codes were changed for two gates accessing the paved area only. The majority of the locks require reset keys to change the combination which field personnel did not have. The reset keys will be acquired, and the remainder of the lock combinations will be updated during a future O&M site visit.

2.4 Summary of Soil Cap Remedy Performance

Overall, upland soil cap observations and inspections revealed no significant change in remedy performance or areas of concern. The soil cap continues to have a consistent layer of vegetative cover across the site (Appendix A, Photograph A15). Future O&M activities will primarily consist of quarterly inspections and routine maintenance, which will monitor the natural re-vegetation of the burned area at the northeast side of the site.

The upland soil cap subsidence near wells EW-1s and MW-23d is currently stable. This area will continue to be monitored in 2020 by taking inner and outer casing measurements at well MW-23d; by monitoring stormwater flow at the outfall during quarterly inspections; and by collecting and reviewing transducer data from EW-1s that measures groundwater temperature and elevation.

3.0 SEDIMENT CAP PERFORMANCE STANDARDS AND ACTIVITIES

This section summarizes sediment cap observation and maintenance activities for the reporting period January 1, 2019, through December 31, 2019. Site observations and maintenance activities were conducted according to the Final O&M Plan. Sediment cap inspections were conducted in February, April, July, and October 2019 by DEQ, Hart Crowser, and GSI in conjunction with inspections for the entire site. Observations of interest from the routine inspections and site meetings are presented on Figure 2-1. Routine inspections are documented in observation forms developed and recorded for the site and are presented in Appendix B. Table 3-1 provides a summary of sediment cap activities conducted in 2019.

3.1 Sediment Cap Performance Standards

The sediment remedy consists of a 23-acre cap over contaminated sediment within the Willamette River and includes ICs. The sediment cap remedy was completed in September 2005, and an Easement and Equitable Servitude was completed in 2006 to restrict sediment cap use and access. Sediment beneath the sediment cap remains contaminated with arsenic, PCP, PAHs, dioxins/furans, and NAPL. The performance standards for the sediment cap are as follows:

- Maintain contaminant concentrations in surface sediment below the following risk-based cleanup goals, as specified in the ROD (EPA 1996).
  - Arsenic: 12 mg/kg, dry weight
  - PCP: 100 mg/kg, dry weight
  - Total carcinogenic PAHs: 2 mg/kg, dry weight
  - Dioxins/furans toxic equivalency (TEQ): $8x10^{-5}$ mg/kg, dry weight
  - Protection of benthic organisms based on sediment bioassay tests, resulting in impaired survival and growth (i.e., weight)
- Minimize contaminant releases from sediment that might result in contamination of the Willamette River in excess of the following federal and state ambient water quality criteria (AWQC):
  - Arsenic (III): 190 micrograms per liter (µg/L)
  - Chromium (III): 210 µg/L
  - Copper: 12 µg/L
  - Zinc: 110 µg/L
  - PCP: 13 µg/L
  - Acenaphthene: 520 µg/L
  - Fluoranthene: 54 µg/L
  - Naphthalene: 620 µg/L
  - Total carcinogenic PAHs: 0.031 µg/L
  - Dioxins/furans: $1.4x10^{-5}$ nanograms per liter (ng/L)
- Maintain the armoring layer to within 50 percent of the design specification throughout the cap. The design specifications are as follows:
  - 6-inch rock armoring: maintain at least 6 inches thick
  - 12-inch rock armoring: maintain at least 7.5 inches thick
  - 24-inch rock armoring: maintain at least 12 inches thick
- Maintain uniformity and continuity of ACB armoring.
- Assess performance of organophilic clay to ensure it is preventing the release of mobile NAPL to the Willamette River (potential assessment parameters include sorption capacity, measure of NAPL currently sorbed, and permeability).

AWQCs listed above were the surface water criteria in effect at the time of the ROD (EPA 1996). Since completion of the ROD, additional recommended EPA water quality criteria were published in 2007, and more stringent AWQCs for human health were adopted by the DEQ and approved by the EPA in 2011.

During meetings in August 2007 among stakeholders (DEQ, EPA, NOAA, Confederated Tribes of Warm Springs, and Yakama Nation), it was agreed that for comparison purposes, the following five criteria would be included in analytical results summary tables in Annual O&M Reports.

- Two AWQCs in effect at the time the ROD was issued:
  - 1996 criteria for chronic effects to aquatic life
  - 1996 criteria for human health based on fish consumption
- Two 2007 National Recommended Water Quality Criteria:
  - 2007 criteria for chronic effects to aquatic life
  - 2007 criteria for human health (consumption of organisms)
- Current EPA maximum contaminant levels

Future comparison criteria will include the EPA-approved 2011 AWQCs updated in 2015 for human health and other applicable AWQCs at the time of sediment cap water sampling. These criteria were used as comparison criteria for the fall 2015 passive surface water and sediment cap porewater sampling event. The next scheduled cap water sampling event is in 2020.

3.2 Sediment Cap Observations

Routine sediment cap inspections were conducted on February 7, April 3, July 18, and October 16, 2019, in conjunction with the four quarterly site inspections. Observations were made regarding habitat enhancement features, wildlife, vandalism, and/or trespassing. Representative site photographs of the Willamette Cove and Willamette River shorelines taken in 2019 are presented in Appendix A. Sediment cap inspection documentation is included in Appendix B. In general, the sediment cap remains in good condition.

3.2.1 Shoreline Conditions

During the October 2018 site inspection, multiple 2- to 6-inch-wide voids were observed in the ACB along the shoreline in the Willamette Cove during seasonal and tidal low water. The gaps were not visible due to water levels during any site inspections conducted in 2019. The gaps will be monitored (when possible) for signs of erosion or impairment of sediment cap armoring in the Willamette Cove.

During the October 2019 quarterly site inspection, a minor amount of erosion was observed at the northwestern end of the turf-reinforced matting (TRM) at the upper edge of the ACB (Appendix A, Photograph A19), likely occurring only during very high water conditions of the Willamette River. The erosional area will be repaired during O&M activities for the site in summer 2020.

On July 18, 2018, a fire burned approximately 1 acre at the northwestern end of the riparian area between monitoring wells MW-39s and MW-43s (Figure 2-1). The fire primarily burned brush and grass undergrowth impacting the riparian area closer to the river (Appendix A, Photograph A3). Vegetation regrowth was monitored throughout 2019. Grass regrowth along the shoreline was complete by the July 2019 site inspection (Appendix A, Photograph A13) with visible signs of the fire, including only burned driftwood tree trunks and charred tree branches. The majority of trees within the burned area survived

with trees developing new buds in the latter half of 2019. Burned holes in the TRM were monitored throughout the year and appeared stable without increases in size (Appendix A, Photograph A9).

Ebullition and shoreline sheen were not observed from the Willamette Cove or Willamette River shorelines during any of the site inspections conducted in 2019.

3.2.2 Habitat Enhancement Features and Wildlife

Habitat enhancement features, such as boulder clusters and sand cover as a biotic layer, are design elements of the sediment cap. Driftwood also provides habitat enhancement along the shoreline and in the riparian area above the shoreline. The distribution of sand cover over the ACB is similar to previous years. Originally, sand was placed over a large portion of the shoreline and Willamette Cove ACB armoring, but high river flow conditions and wakes from passing boats had washed sand from the ACB where the bank slopes are steeper. Rounded 1 ½-inch-minus gravel was placed within the ACB voids along a large portion of the shoreline and Willamette Cove in October 2012. The gravel has largely remained in place through 2019; however, some has washed down steeper shorelines and has settled onto lower ACB surfaces (Appendix A, Photographs A14 and A21).

Large pieces of driftwood are deposited along the shoreline at higher elevations during high river-stage events. The amount of driftwood moving through the site appears to remain fairly consistent every year. Three areas of the shoreline appear to accumulate more woody debris than other areas:

- The south end of the shoreline near the City of Portland outfall.
- Along the shoreline near the former Tank Farm Area (TFA).
- The north end of the site near the Burlington Northern Railroad bridge.

Boulder clusters placed during the sediment cap construction remained in place during 2019.

Numerous wildlife species continue to be observed site-wide; birds seen most frequently include Canada geese, gulls, cormorants, crows, pigeons, blue herons, ospreys, and hawks.

3.2.3 Public Use

The shoreline along the site and Willamette Cove is publicly accessible and used for various forms of recreation. Transient encampments were not observed along the Willamette River shoreline; however, eight dumpsites were observed along the entire length of the shoreline during the February 2019 site inspection (Figure 2-1, Appendix A, Photograph A2). Hart Crowser coordinated with Metro to remove the trash and debris from the dumpsites in March 2019.

Throughout 2019, shoreline trash and graffiti were observed, including beverage and food containers, blankets, clothes, shopping carts, and a large heavy equipment vehicle tire.

Numerous dilapidated boats (presumably used as dwellings) were observed anchored in the Willamette Cove during every site visit (Appendix A, Photograph A1), with the number of boats fluctuating throughout the year. Boats appeared to be anchored beyond the sediment cap, and we did not observe any damage to

the sediment cap from moorage or physical contact by boats in the Willamette Cove. The U.S. Coast Guard and Oregon State Marine Board rules prohibit anchoring on the sediment cap.

3.2.4 Buoys

Five permanent buoys were installed in August 2011, along the perimeter of the sediment cap warning boaters of navigational hazards. Buoys were observed to be in place throughout 2019.

3.3 Sediment Cap Maintenance Activities

The sediment cap was designed to be generally maintenance free. Water events for the riparian area were planned for August and September 2019, but multiple precipitation events occurred during the months eliminating the need for the watering events. No signs of stressed vegetation were observed during the October 2019 site inspection.

3.4 Summary of Sediment Cap Remedy Performance

Overall, the sediment cap observations and inspections during 2019 revealed no significant change in remedy performance or areas of concern. Future O&M activities primarily will consist of quarterly inspections and routine maintenance. Several voids in the ACB, along the Willamette Cove that were observed in 2018 when the water level was at a seasonal and tidal low, were not visible during any inspection in 2019 .

Sediment cap porewater and surface water sampling was conducted in 2015 with results reported in the 2015 Annual Report and the Fourth Five-Year Review (DEQ and EPA 2016). Results indicated that the sediment cap is performing as designed. The next round of porewater and surface water sampling is scheduled to be conducted in 2020, before the Fifth Five-Year Review Report in 2021.

Sand covers the shoreline at lower, less steep elevations, and significant amounts of large driftwood have accumulated to help create wildlife habitat. Numerous wildlife species continue to be observed; various birds including Canada geese, gulls, cormorants, crows, pigeons, blue herons, ospreys, and hawks were observed in 2019.

The public frequents the shoreline for recreation, most commonly for hiking or walking dogs. Rounded gravel used to fill voids within the ACB created a more stable substrate for wildlife and a consistent, safer walking surface for public use, although much of the gravel has been eroded from the upper potions of the ACB and deposited on the lower portion.

4.0 GROUNDWATER PERFORMANCE STANDARDS AND ACTIVITIES

This section summarizes groundwater performance standards and activities for the reporting period January 1, 2019, through December 31, 2019. Groundwater remedy observations and maintenance activities were conducted according to the O&M Plan (DEQ and EPA 2014). Manual NAPL and groundwater

level data were collected during the site-wide semiannual monitoring events conducted on June 5 and September 12, 2019.

4.1 Groundwater Flow Direction and Gradient Assessment

The current monitoring well network is shown on Figure 4 1. Ongoing groundwater monitoring consists of (1) semiannual site-wide manual measurements of NAPL and groundwater levels; and (2) continuous water level measurements in 11 site wells that contain transducers. This section summarizes groundwater flow based on the 2019 water level measurements.

4.1.1 Horizontal Flow Direction and Gradients

Manual groundwater measurements were collected during the falling limb of the hydrograph or immediately following low tide in the Willamette River. The semiannual groundwater elevation data are included in Table 4-1 (June 5, 2019) and Table 4-2 (September 12, 2019).

Shallow groundwater elevation contour maps were developed for each semiannual event during the typical seasonal high (June) and low (September) river stages. As shown in Figures 4-2 and 4-3, the shallow horizontal groundwater gradient within the subsurface barrier wall is independent of the gradient outside the barrier wall. The groundwater gradient inside the barrier wall remains flat (ranging from 0.003 to 0.0008 feet per foot [ft/ft]) compared with the slightly steeper groundwater gradients (ranging from 0.005 to 0.04 ft/ft) outside the barrier wall. On the eastern side of the barrier wall, groundwater flows south/southwest toward the river while on the western side of the wall, the groundwater flows to the west toward the Willamette Cove. This demonstrates that the barrier wall has effectively cut off the hydraulic connection between the shallow groundwater zone inside and outside of its boundaries. The hydraulic separation is further illustrated by the hydrograph on Figure 4-4 from the paired monitoring well cluster MW-53s and MW-52s, located up-gradient of, and just inside, the northeastern edge of the barrier wall; this hydrograph shows groundwater levels outside of the barrier wall (MW-53s) are approximately 4 to 5 feet higher than inside the wall (MW-52s).

Comparison of the groundwater levels for interior monitoring wells EW-1s, MW-44s, MW-52s, and MW-36s (Figure 4-5) illustrate that groundwater gradients within the barrier wall are typically southwesterly (i.e. the water level in EW-1s is typically higher than MW-36s). However, during periods of peak flow in the Willamette River (e.g., April 2019), groundwater levels within the northwest corner of the barrier wall increase and cause a partial gradient reversal (i.e., the water level in MW-36s becomes higher than the levels in other interior wells; Figure 4-5). This partial reversal is caused by a deep hydraulic connection through sand at the base of the western edge of the barrier wall; when the river level exceeds the groundwater level within the barrier wall area, an upward vertical gradient results. Vertical gradients are further discussed in Section 4.1.2.

The hydrographs in Figures 4-4 through 4-8 compare groundwater level elevations for selected well pairs to river stage elevation and precipitation data. River stage data were recorded every 30 minutes from U.S. Geological Survey (USGS) station number 14211720 (USGS 2019a). This station is located on the upstream side of the Morrison Bridge (river mile [RM] 12.8). River stage elevation data reported by USGS are relative

to the Portland River Datum at this location. The river stage data are corrected to the North American Vertical Datum of 1988 (NAVD88) at the site (approximately RM 7) by adding 5.001 feet to the USGS reading. Precipitation data were obtained from the Astor Elementary School rain gauge located approximately 0.5 miles from the site. Daily totals were obtained from the City of Portland Hydra Network available on the USGS website (USGS 2019b). Due to the failure of the on-site barometric pressure transducer, no site-specific barometric pressure data are available from June 5, 2019, through September 12, 2019. During this period, barometric pressure data from the Portland International Airport weather station was used to correct the water levels in the wells with transducers.

4.1.2 Vertical Flow Direction and Gradients

The Willamette River stage directly influences groundwater elevations in the nearshore areas. Daily tidal fluctuations in river stage typically range from 2 to 5 feet during the late summer and fall (July through September) months when stage/discharge is lowest and from 1 to 2 feet during the spring months (April through June) when stage/discharge is highest.

Vertical gradients inside and outside the barrier wall along the Willamette River were assessed in monitoring well clusters MW-36/MW-37 and MW-44/MW-45 (Figure 4-1). Due to battery failure, no transducer data were available for MW-37s from September 22, 2018 through 2019, or for MW-44d between May 17 and June 5, 2019, and between July 13 and September 12, 2019. Hydrographs for these wells (Figures 4-6 and 4-7) indicate that the deep groundwater zone is in direct hydraulic connection with the river. The deep zone both inside and outside of the barrier wall closely mimics the river stage, both in elevation and timing, with small vertical gradient changes that occur in response to the daily tidal changes and seasonal river stage trends. The exterior shallow well MW-45s (Figure 4-7) is also in hydraulic connection with the river and shows about a quarter cycle-delay from river fluctuations and has a dampened amplitude in comparison with the deeper wells. The hydraulic connection between MW-37s and the river could not be assessed due to battery failure.

Shallow groundwater levels within the barrier wall at MW-36s respond quickly to tidal effects observed in the river but are muted in amplitude compared with the variations observed in the river stage (Figure 4-6). MW-44s shows a limited response to tidal effects (Figure 4-7). The muted amplitude or nonexistent response of interior shallow wells, compared with the deep-zone wells, suggests a clear hydraulic disconnect between the shallow aquifer within the barrier wall and the deeper water-bearing zones. This disconnect is due to (1) the presence of the barrier wall, which prevents horizontal flow across it; and (2) the presence of a confining silt layer between the shallow and intermediate zones throughout the majority of the barrier wall area, including near the MW-44/MW-45 well cluster. The shallow interior response is greatest, but still significantly muted, in well MW-36s (Figure 4-6), where a hydraulic connection exists at the base of the barrier wall (which is completed in a sandy unit at depth). Historically, the timing of the groundwater oscillations in MW-36s (interior shallow well) and MW-37s (exterior shallow well) were closely linked, with the amplitude of the changes muted inside the barrier wall.

Figure 4-8 illustrates the net vertical gradient between the shallow and deep water-bearing zones for the MW-44 (interior) and MW-45 (exterior) well clusters, which range from approximately –0.12 to +0.11. On average, the net gradient inside the barrier wall (MW-44s to MW-44d) continues to be slightly downward.

The net downward gradient is greater inside the barrier wall because the net shallow groundwater elevation inside the barrier wall continues to be slightly elevated compared with the net river stage. The net vertical gradient outside the barrier wall on the river side (MW-45s to MW-45d) is smaller and varies upward and downward according to the trends of the Willamette River. Neutral or upward vertical gradients occur when the river stage is at a higher elevation for a prolonged period, which occurred several times between April and July 2019.

Although precipitation in the Willamette River watershed ultimately affects the stage of the river, direct precipitation near the site appears to play a minor role in determining the water levels of wells within the barrier wall and along the river. The Resource Conservation and Recovery Act (RCRA)-type soil cap at the site was designed to divert precipitation so that little infiltration occurs within the barrier wall. Although some infiltration occurs along the fringes of the soil cap and within the riparian zone, the volume of infiltration is minimal. Between the barrier wall and the river, precipitation inputs are vastly overshadowed by the response of groundwater to variations in river stage. The shallow zone up-gradient or cross-gradient from the barrier wall appears to react subtly to precipitation and is less connected to the river because of its distance from the river and the presence of the barrier wall, which is sealed into the underlying silt. One location where infiltration may influence groundwater elevation and flow path is in the retention pond (Figure 1-3) that receives diverted runoff from the soil cap. Historical groundwater level data indicate that the groundwater gradient in this area is flat, although a slight groundwater mound east of the soil cap may be present seasonally.

4.2 NAPL Gauging and Monitoring Assessment

Between February 1993 and April 2011, approximately 6,550 gallons of NAPL were extracted from site wells. Because recovery was slow and there was uncertainty about the benefits of ongoing recovery, a NAPL investigation in the former waste disposal area (FWDA) outside the barrier wall (the remaining area with active NAPL recovery) was conducted in 2011. Based on the findings from the NAPL investigation (Dense Nonaqueous-Phase Liquid [DNAPL] Data Gap Investigation; Hart Crowser and GSI 2011a) and extensive monitoring of the sediment cap (described in the Third Five-Year Review Report [DEQ and EPA 2011]), the DEQ and EPA decided to discontinue NAPL extraction on April 20, 2011. Subsequent monitoring of the post-extraction NAPL thickness in the FWDA was conducted in 2011 (Hart Crowser and GSI 2011a). The results supported the regulatory decision and confirmed that the residual NAPL in the FWDA is isolated and stable and does not pose a risk to the Willamette River. To confirm that this remains the case and to continue to evaluate the functional performance of the barrier wall and soil cap, NAPL presence and thickness continues to be monitored during the semiannual monitoring events.

Measurable quantities of NAPL were present in 10 site wells (EW-1s, EW-8s, EW-10s, EW-15s, EW 18s, EW-23s, MW-20i, MW-22i, MW-Ds, and MW-Gs) gauged semiannually in 2019. Figures 4-9 and 4-10 show the locations of wells that contained measurable quantities of light NAPL (LNAPL) and/or DNAPL for the June and September 2019 monitoring events, respectively. Tables 4-1 and 4-2 provide semiannual NAPL gauging measurements. Figures 4-11 through 4-20 show the NAPL and groundwater elevations versus time in the above mentioned wells that routinely contain NAPL. The screened interval elevations and the well depth are also shown. The thickness of LNAPL can be calculated by subtracting the LNAPL elevation (when

LNAPL is present) from the groundwater elevation. Similarly, the DNAPL thickness is represented by the difference between the DNAPL elevation and the well depth elevation.

Given that NAPL within the barrier wall is constrained laterally by the barrier wall, NAPL observations outside of and within the barrier wall are discussed separately below.

4.2.1 Outside the Barrier Wall

Historically, NAPL has primarily been observed outside the barrier wall next to the west corner of the enclosure that corresponds to the FWDA (Figure 1-5). During the September 12, 2019, monitoring event, trace LNAPL was noted at eight wells (MW-39d, MW-39i, MW-39s, MW-43d, MW-43s, MW-45i, MW-47s, and MW-49s) outside the southwestern and eastern borders of the barrier wall (Figure 4-10). None of these locations have had observations of LNAPL in the past, so the detections during the September 12, 2019 monitoring event may be due to equipment malfunction as they were collected from the same interface probe. Cross contamination is not believed to be the source of the trace LNAPL detections as the interface probe was decontaminated between each well using a Liquinox detergent solution and then rinsed with distilled water. Additionally, the interface probe was not used on wells known to contain LNAPL and were also gauged in the grouping order presented in Table 9.1 of the O&M Plan. The interface probe did not exhibit signs of malfunction in the field; however, it was the only probe used by the field technician and subsequent water level measurements using different interface probes have not detected LNAPL in those wells. If detections are observed in 2020 and the thickness of LNAPL becomes measurable, the potential for LNAPL mobilization at the site will be reassessed.

In 2019, measurable quantities of DNAPL were observed in four wells (EW-10s, MW-20i, MW-Ds, and MW Gs) outside the barrier wall (Figures 4-9 and 4-10). As shown on Figures 4-11 through 4-14, the DNAPL thicknesses measured in wells EW 10s, MW-20i, MW-Ds, and MW-Gs in 2019 have been generally stable since NAPL recovery was discontinued in April 2011; slight increases were noted in September 2019 but are still generally within observed NAPL thickness fluctuations. This is consistent with historical observations and supports the conclusion that NAPL observed in the FWDA is localized and relatively stable. There is no evidence of NAPL mobility either across the barrier wall or to the Willamette River.

4.2.2 Inside the Barrier Wall

During semiannual monitoring, measurable LNAPL was present in two wells (EW-15s and EW-23s) within the barrier wall (Figures 4-9 and 4-10). Previously, LNAPL was measured in MW-56s, but no LNAPL was detected in MW-56s in 2019. Figures 4-15 and 4-16 show the elevation of LNAPL and shallow groundwater overtime in wells EW-15s and EW-23s, respectively. As shown in these figures, the LNAPL thickness is generally greater when the groundwater elevation is low. This is the result of gravity drainage of LNAPL through the unsaturated zone when the water table drops. This pattern has been consistent since mid-2006 when LNAPL ceased being recovered inside of the barrier wall (i.e., LNAPL thickness was not disturbed by recovery). Although the LNAPL thickness varies cyclically with changes in the groundwater elevation, the overall LNAPL thickness in these wells has remained relatively stable, with slight increases during low groundwater levels.

During the September 12, 2019, monitoring event, trace LNAPL was noted at 10 wells (MW-36i, MW-38d, MW-38i, MW-38s, MW-40i, MW-40s, MW-42d, MW-42i, MW-46s, and MW-48s) inside the barrier wall (Figure 4-10). None of these locations have had observations of LNAPL in the past, so the detections during the September 12, 2019, monitoring event may be due to equipment error for the reasons discussed in Section 4.2.1.

Measurable DNAPL was present during the 2019 semiannual monitoring events within the barrier wall near the former TFA (Figure 1-5) in wells EW-1s, MW-22i, EW-8s, and EW-18s, as shown on Figures 4-17 through 4-20, respectively. The DNAPL thickness in well EW-1s (Figure 4-17) has increased to a thickness of approximately 8 feet since mid-2011, after termination of a temporary recovery period in April 2011. However, in September 2019, the DNAPL thickness was measured at approximately 4 feet. The DNAPL thickness in well MW-22i is approximately 6 feet thick (Figure 4-18). Approximately 2 feet of DNAPL is consistently present within the sump of well EW-8s, with occasional spikes in the DNAPL thickness up to approximately 22 feet, as observed during the June 2019 monitoring event (Figure 4-19). The DNAPL thickness in EW-18s has been generally stable at approximately 2 feet since 2012 (Figure 4-20). However, during the monitoring event on June 5, 2019, there was only a trace amount of DNAPL present in the well, which was followed by an increase of just under 2 feet in September 2019. DNAPL thickness decreases in EW-18s have been observed previously, with the most recent in June 2018 of 0.20 feet. The decrease is not considered anomalous, however, it is not typical for the well.

Overall, both LNAPL and DNAPL appear to be stable except for the DNAPL at EW-8s (Figure 4-19). The large increase in DNAPL thickness at EW-8s in June 2019 is consistent with historical patterns but to a greater magnitude. Given these observations, mobilization of LNAPL or DNAPL either across the barrier wall or to the Willamette River is unlikely.

4.3 Groundwater Remedy Maintenance Activities

Table 4-3 provides the groundwater O&M activities conducted in 2019. Transducer data loggers were inspected during the semiannual monitoring events in 2019. Currently, all well transducers at the site are functional and installed in the wells shown on Figure 4-1. The site-specific barometric pressure transducer was replaced on February 28, 2020.

We performed a monitoring well inspection during the March 25, 2019, O&M visit to photo-document each well in the monitoring well network and complete minor repairs. Repair items included replacing missing well caps and missing or non-functional well locks (e.g., locks rusted shut). Several items were identified during the O&M visit that were not able to be addressed that day and include the following.

- The well box for MW-59s had sunken in the gravel roadway and the well box lid could no longer be bolted down to properly close the well box.
- Well caps could not be installed for three wells (EW-15s, EW-23s, MW-23d) as the casing would not accept 4-inch-diameter well caps and bigger well caps were not available. The wells were still able to be secured with locks on the well monument lids.

- Bolts for the MW-1r well box lid were missing and the bolt holes were stripped. The lid could not be bolted down but the well was still able to be secured with a locked well cap.
- The well cap could not be properly installed on the metal casing of MW-20i because the circular opening of the casing was slightly deformed.

After obtaining additional materials and tools, Hart Crowser performed repairs to the items listed above during the next O&M visit on May 17, 2019, with the exception of the sunken well box for MW-59s. Hart Crowser and the DEQ discussed the sunken MW-59s well box during the April 2019 quarterly site inspection and agreed that the well casing could be trimmed down prior to the upcoming site surveying activities (Section 2.2.2) so that the well casing elevation could be resurveyed. On August 21, 2019, Hart Crowser trimmed the well casing for MW-59s down by 2.125 inches so that the well box lid could be properly bolted down (Appendix A, Photographs A16 and A17).

4.4 Summary of Groundwater Remedy Performance

Hydraulic conditions are consistent with conditions reported for previous years, verifying that the remedy continues to function as designed. Groundwater monitoring data are used to understand groundwater flow conditions inside and outside of the barrier wall. This information is evaluated to determine whether the barrier wall and impermeable RCRA-type soil cap are functioning as designed.

There was no measurable LNAPL in wells outside the barrier wall. DNAPL was measured in four wells outside the barrier wall. The DNAPL in these wells has remained stable with some variation due to temperature and pressure (coincident with water level variation). Based on the findings from the DNAPL Data Gap Investigation (Hart Crowser and GSI, 2011a), subsequent monitoring of the post-extraction NAPL thicknesses in wells in the FWDA, and extensive monitoring of the sediment cap (described in the Third and Fourth Five-Year Review Reports [DEQ and EPA 2011; DEQ and EPA, 2016]) and groundwater, the decision to discontinue NAPL recovery is justified, and residual NAPL remaining in the FWDA does not pose a threat to the Willamette River.

Based on the evaluation of groundwater data from 2005 through 2019, the barrier wall and impermeable soil cap are functioning as designed to divert groundwater flow around NAPL source areas; prevent rainwater infiltration into NAPL source areas contained within the barrier wall; and contain NAPL within the barrier wall to prohibit it from migrating to the Willamette River.

5.0 VEGETATION MANAGEMENT

This section summarizes the vegetation management and monitoring activities for the reporting period from January 1, 2019 through December 31, 2019. Vegetation management activities on the upland cap were conducted in accordance with the McCormick and Baxter Vegetation Management Plan (Hart Crowser and GSI 2011b).

The upland cap was constructed during a 2-year period beginning in 2004 with the re-grading of the Willamette River bank. The 6-acre riparian area cap was installed and tied into the in-water sediment cap. In 2005, a 34-acre multiple-component designed soil cap was constructed to complete the upland cap. The

City of Portland Bureau of Environmental Services (BES) entered into an Intergovernmental Agreement (IGA) with the DEQ to provide vegetation planning and vegetation management services for the upland cap from 2005 through 2010. In February 2006, the soil cap was planted with native grasses, plants, and trees, and an irrigation system was installed. After the fifth growing season, BES determined that the vegetation was fully established, and the irrigation system was no longer needed. The irrigation system was inactivated in 2009 and decommissioned in 2015. Overall, the planting and vegetation management goals have been met.

Semiannual noxious weed control activities, including herbicide application, were conducted from spring 2006 through spring 2013. Herbicide application was temporarily discontinued in June 2013 when nearby desirable native vegetation was observed to be stressed and dying. No herbicide was applied in 2014 and 2015, but was resumed in 2016 after noxious weeds appeared to be spreading. One herbicide application was completed in May 2017 and no herbicide application was performed in 2018. Herbicide application resumed in 2019 (Section 5.4.1).

Rodents that inhabit the cap have damaged vegetation in the past; however, with the exception of some earlier targeted damage to the grand fir (*Abies grandis*) seedlings (BES 2010), there has been insignificant damage to other plantings. Rodent activities are monitored during quarterly site inspections and were not observed to be causing significant damage during site visits in 2019.

On July 19, 2018, a fire burned approximately 1 acre at the north end of the riparian area as shown in Figure 2-1. On September 24, 2018, another fire burned approximately 1 acre along the northeast side of the site, approximately 200 feet southeast of the site maintenance building and along the inside of the fence line. Vegetation recovered in these areas by July 2019.

5.1 Vegetation Management Components and Goals

The upland cap has five distinct components, each with corresponding goals and objectives for managing hydrology, soil, and wildlife habitat (Figure 5-1). These components are:

- Entrance Area
- Earthen Cap
- Stormwater Retention Pond and Drainage Swale
- Impermeable Cap
- Riparian Area

Performance standards to assess whether the planting goals in the DEQ/BES IGA for the entire upland cap are met include:

- Bare soil spaces are small and well dispersed.
- Soil movement, such as active rills or gullies and soil deposition around plants or in small basins, is absent or slight and local.
- Plant litter is well distributed and effective in protecting the soil with few or no litter dams present.

- Native woody and herbaceous vegetation and germination micro-sites are present and well distributed across the site.
- Vegetation structure results in rooting throughout the available soil profile.
- Plants have normal, vigorous growth form and a high probability of remaining vigorous, healthy, and dominant over undesired competing vegetation.
- Stream banks have less than 5 percent exposed soil with margins anchored by deeply rooted vegetation or coarse-grained alluvial debris.
- A continuous corridor of shrubs and trees provides shade for the entire stream bank.

Specific goals were also set for planting the riparian area to create habitat, including elements such as large woody material, riparian vegetation for food, habitat cover and shelter, and shading (NOAA 2004).

5.2 Baseline Conditions in 2011

In 2010, BES determined that the vegetation had been fully established, as discussed in its final 2010 Vegetation Management Report (BES 2010). Hart Crowser assumed responsibility for the vegetation management at that time. On June 10, 2011, a Hart Crowser ecologist inspected the upland cap to confirm the vegetation conditions discussed in the report. The inspection included visual observation of vegetation planting areas, species identification (native, non-native, and invasive), growth, density, general coverage, and relative health of vegetation throughout the site. Photographs were taken to establish a baseline to evaluate the progress of the vegetation re-establishment and the qualitative observations at select site locations. These locations or "Photograph Stations" are shown on Figure 5-1 and include Photograph Stations 1 through 9. The following sections summarize the initial conditions and observations made during the baseline visit in June 2011.

5.2.1 Riparian Area

The riparian area is divided into two components: upper and lower. Each component received similar vegetation treatments. The lower component is subject to Willamette River stage fluctuations, which influence vegetation conditions at its lower edge during high-water events. Vegetation, some weeds, and woody debris are present along the shoreline (Photograph Stations 7 and 9). Trees, shrubs, and herbaceous plants are present in the riparian area (Photograph Station 8).

Lower Component. The lower component originally was planted with a variety of native trees and shrubs including: Oregon ash (*Fraxinus latifolia*), Suksdorf's hawthorn (*Crataegus suksdorfii*), cascara (*Rhamnus purshiana*), hardhack (*Spiraea douglasii*), red-osier dogwood (*Cornus sericea*), Pacific ninebark (*Physocarpus capitatus*), swamp rose (*Rosa pisocarpa*), river willow (*Salix fluviatilis*), Sitka willow (*Salix sitchensis*), rigid willow (*Salix rigida*) [*sic:* taxonomic update -MacKenzie's willow (*S. prolixa)*], Piper's willow (*Salix piperi*) [*sic: S. hookeriana*], and black twinberry (*Lonicera involucrata*). Groundcover species planted in the lower component included: California brome (*Bromus carinatus*), blue wildrye (*Elymus glaucus*), meadow barley (*Hordeum brachyantherum*), slender hairgrass (*Deschampsia elongata*), spike bentgrass (*Agrostis exerata*), globe gilia (*Gilia capitata*), lupine (*Lupinus albicaulis*), and Canada goldenrod (*Solidago canadensis*). Tree plantings were not installed at lower elevations in the lower component of the riparian

area because of the potential for late season inundation from high river levels. Instead, appropriate shrubs, primarily willows, were installed along the lower edge of this component to provide food and shade. A significant quantity of large woody debris was observed along the entire length of the lower edge. Trees and shrubs within the lower component were observed to be well established and growing both vertically and laterally. No indications of stress were noted. Localized areas of exposed TRM were observed along the length of the lower edge of the TRM, likely because of river fluctuations and movement of large woody debris along the shoreline. Canada thistle (*Cirsium arvense*) was the most common noxious weed with lesser quantities of knapweed (*Centaurea Sp.*) and butterfly bush (*Buddleia davidii*) present.

Upper Component. The upper component was planted with native vegetation including: red alder (*Alnus rubra*), big-leaf maple (*Acer macrophyllum*), Western red cedar (*Thuja plicata*), madrone (*Arbutus menziesii*), grand fir, Garry oak (*Quercus garryana*), Oregon ash, black hawthorn, cascara, red elderberry (*Sambucus racemosa*), blue elderberry (*Sambucus cerulea*), Nootka rose (*Rosa nutkana*), tall Oregon-grape (*Mahonia aquifolium*), snowberry (*Symphoricarpos albus*), red-flowering currant (*Ribes sanguineum*), oceanspray (*Holodiscus discolor*), red-osier dogwood, black twinberry, and Pacific ninebark. Groundcover species in the upper component are identical to those in the lower component. Similar to the lower component, trees and shrubs were well established and appeared healthy. In 2011, trees were 6 to 12 feet tall. Few areas containing bare ground were observed. Thistle and knapweed were present in small quantities among the groundcover plantings throughout the upper component.

Summary. In general, the riparian area components appeared to be performing well, with the installed trees and shrubs looking healthy and spreading. Groundcover species provided relatively good coverage of the soil, with the exception of a few areas containing bare ground and observed TRM along the shoreline. In addition, large driftwood was present throughout the lower component and in smaller quantities within the upper component. Noxious weeds, including thistle, knapweed, and butterfly bush were present in small quantities within the riparian area.

5.2.2 Upland Area

The upland area is divided into three components: the earthen cap; the stormwater retention pond/drainage swale; and the impermeable cap (Figure 5-1). A variety of native trees, shrubs, and herbaceous species are present on the earthen cap as shown in photographs captured at Photograph Stations 1, 2, 3, and 5 (Appendix C). Native shrubs and herbaceous species are present in the stormwater retention pond/drainage swale (Photograph Station 4). Meadow grasses and herbs are present on the impermeable cap (Photograph Station 6).

Earthen Cap Component. Originally, this component was planted with a variety of native trees, shrubs, and grasses including: Garry oak, Ponderosa pine (*Pinus ponderosa*), black hawthorne (*Crataegus douglasii*), madrone, snowberry, blue elderberry (*Sambucus cerulea*), Oregon-grape, Nootka rose, red-flowering currant, oceanspray, serviceberry (*Amelanchier alnifolia*), and mock orange (*Philadelphus lewisii*). Herbaceous species installed on the earthen cap included chewings fescue (*Festuca rubra* var. *comutata*), California brome, meadow barley, slender hairgrass, Spanish clover (*Lotus purshiana*), claria (*Clarkia amoena*), globe gilia, meadow checkermallow (*Sidalcea campestris*), large-leaved lupine (*Lupinus polyphyllus*), and Canada goldenrod. By 2011, nearly all of these plant varieties remained on the earthen

cap and appear to be well established and growing both vertically and laterally. Nootka rose had dominated the northwest corner of the earthen cap component; however, some of the Nootka rose appeared to have been highly stressed or had died, and most were regenerating. The black hawthorn had grown to 6 to 8 feet tall. Localized areas of moss were observed within the grasses and herbaceous vegetation. Small quantities of knapweed and thistle were also present.

Stormwater Retention Pond/Drainage Swale Component. This component was planted with a native shrub overstory consisting of hardhack, Sitka willow, and Piper's willow (Photograph Station 4). Volunteer red alder and black cottonwood (*Populus balsamifera*) were observed among the shrub plantings. Understory herbaceous species were planted in the pond and swale area based on anticipated inundation within the pond and swale area and included: water plantain (*Alisma plantago aquatica*), slough sedge (*Carex obnupta*), soft stem bulrush (*Schoenoplectus tabernaemontanii*), small-fruited bulrush (*Scirpus microcarpus*), Western sloughgrass (*Beckmania syzigachne*), Western mannagrass (*Glyeria occidentalis*), tufted hairgrass (*Deschapsia cespitosa*), slender hairgrass, meadow barley, spike bentgrass, meadow foxtail (*Alopecuris geniculatus*), self heal (*Prunella vulgaris*), Spanish clover, and gumweed (*Grindelia integrifolia*). The shrub plantings in the pond and swale area were well established and appeared healthy. Many of the grasses and herbs in the pond area did not survive because the infiltration of surface runoff limits moisture and the understory is dominated by sand and bare ground. Given that the shrubs were well established, the area is flat, and erosion generally was not occurring, replanting grasses and herbs was not recommended. No noxious weeds were observed in this component.

Impermeable Cap Component. This component was seeded with a grassland mixture including: chewings fescue, California brome, meadow barley, slender hairgrass, large-leaved collomia (*Collomia grandiflora*), globe gilia, large-leaved lupine, and Canada goldenrod. Grassland species provided excellent cover of the impermeable cap. Moss was present in localized areas where grasses and herbs did not become established. Small quantities of knapweed, thistle, skeletonweed (*Chondrilla juncea*), and dandelion (*Taraxacum officinale*) were present within the southwestern portion of this component and did not appear to be encroaching on desirable vegetation.

Summary. In general, the upland area appeared to be performing well in 2011 (baseline conditions) with the installed trees and shrubs looking healthy and spreading on the earthen cap component, shrubs being well established within the stormwater retention pond/drainage swale component, and good soil coverage and vegetative diversity on the impermeable cap component. Groundcover species provided excellent coverage of the ground, except for a few sections containing bare ground and the relatively bare understory in the pond area. Limited quantities of noxious weeds were observed in the upland area and were primarily limited to the southwestern edge of the impermeable cap component.

5.3 Vegetation Observations in 2019

On May 16, 2019, Hart Crowser inspected the upland cap to assess the current conditions as compared to the baseline conditions observed in June 2011. Qualitative data were recorded on species composition, cover and density of vegetation, and effectiveness of previous noxious weed treatments. Photograph Stations during this inspection were paired with photographs from previous reports to provide an understanding of vegetation changes. Photograph Stations are shown on Figure 5-1. Species nomenclature

and nativity follows U.S. Department of Agriculture standards (U.S. Department of Agriculture 2020). Baseline and current observations are summarized below.

5.3.1 Riparian Area

Lower Component. In 2019, dominant species were similar to 2011 conditions with Oregon ash, cascara, Pacific ninebark, black twinberry and several willow species growing well. Much of the herbaceous layer was characterized by wildrye, fescue (*Festuca pratensis*), downy brome (*Bromus tectorum*), and a variety of forbs that came up from the seed bank. A small portion of this lower area was accidentally burned in 2018. The fire top-killed many of the shrubs. The hawthorn, twinberry, elderberry, ninebark, snowberry (*Symphoricarpos albus*), and cascara were all seen re-sprouting well (Appendix C, Photographs C19 to C21). Many of the woody plants survived the fire. Newly exposed soil of the burned area had a higher density of turnip (*Brassica rapa*). Although non-native, this mustard will fade into the seed bank in the next couple years as the perennial grasses and shrubs take hold again. No indications of stress were noted.

Small, localized areas of TRM are visible along the length of the lower edge of the TRM, but adventive vegetation is continuing to cover the areas since repairs were made in December 2015. A significant quantity of driftwood was observed along the entire length of the lower component of the riparian area. Large driftwood pieces continue to accumulate along the shoreline to the middle of the bank near the break between the upper and lower components. Canada thistle was the most common noxious weed with some knapweed and butterfly bush also present.

In 2017, herbicide application was successful at treating the black mustard (*Brassica nigra*), scotch broom (*Cytisus scoparius*), knapweed, and Canada thistle; however, some thistle was still observed in the lower portion of the riparian area. No herbicide treatment was performed in 2018. In 2019, several noxious weeds in the area were sprayed including Canada and bull thistle (*Cirsium vulgare*), butterfly bush, and Indigo bush (*Amorpha fruticosa*). Shiny-leaf geranium (*Geranium lucidum*) was also noted within the articulated block of the riparian zone (Appendix C, Photographs C23 and C24). Noxious weeds are discussed in more detail below.

Upper Component. In 2019, trees and shrubs in the upper component were well established and appeared healthy with trees being 6 to 12 feet tall. Few areas containing bare ground were observed. Thistle and knapweed were present in small quantities among the groundcover plantings throughout the upper component.

Since 2016, the riparian area is watered once or twice in the summer if drought conditions or stressed vegetation is observed. Ponderosa pine (*Pinus ponderosa*), madrone, Nootka rose, snowberry, Oregon-grape, hawthorn, and blue elderberry appeared well established and performing best within this area. Approximately 80 to 90 percent of the grand fir perished during the 2015 summer drought. In July 2018, a fire burned approximately 1 acre at the north end of the riparian area and reduced the woody biomass but did not kill too many of the woody species. Following a period of dry weather and the fire in the riparian area, approximately 2,500 gallons of water was used on August 8, 2018, to avoid excessive late season drought stress that was experienced in 2015 and to a lesser degree in 2016.

In 2019, shrubby species like oceanspray, cascara, twinberry, and Pacific ninebark, all stump sprouted well and are surviving. Taller species like bigleaf maple and madrone had their lower branches burned by the fire and are doing well; however, coniferous species such as cedar and fir were a total loss. The area vacated by these species is quickly being invaded by other native species, especially snowberry, elderberry, and roses. The herbaceous species planted are doing well locally. In much of the area these species are being forced out by the native shrubs. Areas still dominated by herbaceous species are found in the more southern portion of this zone. Here checkermallow, large-leaved and sicklekeel lupine, horsetail (*Equisetum arvense*), self-heal, and many species of grasses are present. Overall, this zone is doing very well and is completely covered by primarily native species. Many of these native species that came up from the seed bank like horsetail, gumweed, several species of cudweed (*Pseudognaphalium* sp.), and poison-oak (*Toxicodendron diversilobum*) provide good wildlife value.

Several B-list noxious weeds were also found within this zone that include Canada thistle, two knapweeds (*Centaurea diffusa* and *C. stoebe*), Scotch broom, common St. John's-wort (*Hypericum perfoliatum*), tansy ragwort (*Senecio jacobaea*) and a small amount of Himalayan blackberry (*Rubus armeniacus*). Also found was tansy (*Tanacetum vulgare*), an invasive species not found on the Oregon Noxious Plant List (Oregon Department of Agriculture 2019). Since this species is invasive in character, has started to form large patches at the site, and its inclusion on other states' lists as a noxious plant, we included it on our list. Further discussion of noxious plants is described below.

5.3.2 Upland Area

The upland area is divided into three components: the earthen cap; the stormwater retention pond/drainage swale; and the impermeable cap (Figure 5 1). A variety of native trees, shrubs, and herbaceous species are present on the earthen cap as shown in Photographs C1 through C6 (Appendix C). The stormwater retention pond/drainage swale and the vegetation coverage on the impermeable cap are shown on Photographs C7 and C8, and Photographs C11 and C12, respectively (Appendix C).

Earthen Cap Component. In 2019, the area is fully vegetated with sporadic patches of trees and shrubs with nearly all of the originally planted varieties present. Tree and shrub plantings on the earthen cap are healthy and growing well (Appendix C, Photographs C9 and C10). Ponderosa pine, Oregon grape, blue elderberry, lupine, rose and serviceberry continue to be performing the best. Nootka rose dominates the northwest portion of the earthen cap. Trees and shrubs range in height from approximately 6 to 20 feet. Herbaceous species provide full coverage of the ground. During our June 2019 site visit, gumweed, three species of lupine, mullein (*Verbascum thapsus*), Canada goldenrod, and many species of grasses dominated the earthen cap. No indications of significant stress were observed.

Scattered areas of noxious weeds were located during 2019, including spotted knapweed, tree of heaven, Canada thistle, bull thistle, tansy ragwort, skeletonweed, Scotch broom, medusahead rye and Himalayan blackberry. The latter three species were becoming locally common. Most of these were treated through herbicide application (Section 5.4.1).

Stormwater Retention Pond/Drainage Swale Component. In 2019, dense shrub and tree thickets were found to the north and east of the pond. The shrub plantings established well, although many of the

grasses and herbs in the pond area did not survive because the infiltration of surface runoff limits moisture and the understory is dominated by sand and bare ground. The pond depression is too dry for successful wetland vegetation like those that were planted. The depression is primarily vegetated by annual grasses: silver hairgrass (*Aira caryopyllea*) and annual fescue (*Vulpia myuros*). A good shrubby edge around the pond and swale was present of Sitka and piper's willow up to 15 feet tall (Appendix C, Photographs C7 and C8), red-osier dogwood, black cottonwood, snowberry, and butterflybush. The butterflybush was sprayed in 2019.

Impermeable Cap Component. In 2019, barley, hair grass, and lupine have performed the best of the species seeded in 2011. A recent survey of this area found these species as dominants along with gumweed, velvet grass (*Holcus lantana*), sweet vernal grass (*Anthroxanthum odoratum*), and downy brome. Small populations of noxious weeds were present, including spotted knapweed, Canada and bull thistle, and skeletonweed. Larger populations of the B-listed noxious weed, medusahead rye, was in the more disturbed areas of the cap and along paths. This annual would be hard to eliminate and would be best controlled by an increased dominance of perennials.

5.4 Vegetation Maintenance Activities

This section describes activities conducted to maintain vegetation in 2019. The general planting goals continue to be met.

5.4.1 Noxious Weed Control

A preventive control approach continues to be implemented as part of an ongoing effort to control the spread of noxious weed species. Spot spraying was last completed over the entire site in May 2017. This followed weed suppression efforts in spring and fall of 2016. No herbicide was applied in 2018. In 2019, after a survey of noxious species, a total of 14 B-list noxious and one notably invasive species were observed (Table 5.1). No A-list noxious species were identified.

On June 5, 2019, these weeds were treated using Vastlan® at 1.5 percent and 50 percent for stump application (Appendix C, Photographs C25 through C28). The active ingredient in Vastlan® is 54.72 percent triclopyr choline: 2-[(3,5,6-trichloro-2-pyridinyl)oxy] acetic acid, choline salt. It is formulated for woody plants and broadleaf weeds while offering a high degree of safety to grasses. The herbicide treatment was very successful. Larger patches of Himalayan blackberry, Scotch broom, butterflybush, indigo bush, and tree of heaven that were the primary goals of the effort were successfully removed. Due to the seed bank and birds moving seed in, these species will always be a challenge.

Due to exceptionally dry summer conditions, irrigation water was applied in the riparian area to help alleviate stressed vegetation in 2015, 2016, and 2017. In 2018, as a precautionary measure and to encourage plant growth in areas damaged by the July 2018 fire, one watering event was completed in August 2018. No watering events were needed in 2019 due to frequent summer rainfall.

5.5 Vegetation Performance Summary

Overall, the tree, shrub, and herbaceous plantings are well established and are spreading throughout the site. Most of the woody vegetation that was planted or that came in through natural corridors is native. Much of the stormwater retention pond remains vegetated by non-native annual grasses or is unvegetated. Native willow and black cottonwood are growing in and around the depression and are spreading. Herbaceous and woody species are providing excellent coverage for the rest of the site. Noxious weed coverage was reduced by the 2017 spring herbicide application, and again in 2019. During 2019, more B-list noxious species were identified and treated than in 2017. The vegetation has rebounded from the fires in 2018 and these areas will be fully vegetated naturally in the next year or two without any intervention. A vegetation inspection in June 2020 will document which species are thriving and provide maintenance recommendations if necessary.

The exceptionally dry summer conditions in 2015 resulted in significant stress of the riparian community and other localized habitats across the site. Vegetation recovered in 2016 and 2017, although many conifers in the upper riparian area died. As the surviving woody plants become well established, they will have better means for withstanding drought conditions in the future. Vegetation monitoring will continue to be performed during summer 2020, and additional watering will be provided in the case of another severe drought.

6.0 SUMMARY OF OVERALL REMEDY PERFORMANCE

Overall, the 2019 soil and sediment cap observations and inspections and groundwater monitoring revealed no significant change in remedy performance or areas of concern. The remedy continues to perform as designed and is protective of human health and the environment.

7.0 SUMMARY OF PLANNED ACTIVITIES FOR 2020

The Final O&M Plan with descriptions and schedule of O&M activities was completed by the DEQ with assistance from the EPA, GSI, and Hart Crowser in March 2014.

Table 7-1 presents the soil cap O&M activities planned through 2024. Soil cap O&M activities in 2020 will consist primarily of quarterly inspections and routine maintenance. Semiannual inspections should be continued in 2020 to assess and monitor vegetation planting areas, species identification (native, non-native, and invasive), growth, density, and general coverage throughout the site. The need for noxious weed control activities will be evaluated based on site and vegetation inspections. If the site experiences drought conditions in 2020, the majority of woody species are in danger of being lost. Due to their shallow rooting, the remaining conifers will show the water stress earlier. Conditions will be monitored during the summer months and, if dry conditions are prevalent, a drought assessment survey will be conducted to determine if additional watering is needed. A water tank trailer and firehose has worked well to apply water throughout the site and this same technique will be used again, if needed.

Table 7-2 presents the sediment cap O&M activities planned through 2024. In 2020, routine activities will include quarterly inspections and routine maintenance, cleanup of riparian area trash and dumpsites, (if

present). In anticipation of the 2021 Fifth Five-Year Review, Sediment cap performance will be evaluated by collecting and analyzing surface water, inter-armoring, and sub-armoring water samples from the sediment cap. Background surface water samples will also be collected from upstream and downstream locations to the site. Crayfish tissue will also be collected and analyzed.

Groundwater O&M activities through September 2024 are summarized in Table 7-3. In anticipation of the 2021 Fifth Five-Year Review a groundwater sampling event will occur in 2020. Routine maintenance of the data logger transducers and barometric pressure transducer are also included as elements of groundwater O&M.

8.0 REFERENCES

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TABLES

Table 2-1: Soil Cap O&M Activities in 2019
2019 O&M Annual Report
McCormick and Baxter Superfund Site

O&M Activity	Frequency in 2019
Visual Inspections:	
Cap surface	February, April, July, October
Subsidence near EW-1s	February, April, July, October
Stormwater conveyance system	February, April, July, October
Security fencing	February, April, July, October
Warning signs	February, April, July, October
Abundance and survival of vegetation	February, April, May, June, July, October
Routine Maintenance and Monitoring:	
Manual removal of invasive plants	March
Targeted application of herbicides	June
Non-Routine Maintenance:	
Land survey for subsidence monitoring	August
Video inspection of storm sewer	October
Filling of potential animal burrow into the earthen cap	February, May
Fire damage inspections	February, April, July, October
Utilities Service:	
Water (Backflow Testing)	September

Table 3-1: Sediment Cap O&M Activities in 2019
2019 O&M Annual Report
McCormick and Baxter Superfund Site

O&M Activity	Frequency in 2019
Visual Inspections (from shore):	
Warning buoys	February, April, July, October
Cap surface	February, April, July, October
Habitat quality	February, April, July, October
Routine Monitoring:	
Water column and inter-armoring water sampling	None
Organoclay core sampling	None
Non-Routine Monitoring:	
Multibeam bathymetric surveys, side-scan sonar survey	None
Non-Routine Maintenance:	
Cut articulated concrete block cable loops	As needed

Table 4-1: Groundwater and NAPL Elevations: June 5, 2019
2019 O&M Annual Report
McCormick and Baxter Superfund Site

Well ID	Date	Time	Measuring Point Elevation (ft NAVD88)	Depth to LNAPL (ft below MP)	Depth to water (ft below MP)	Depth to DNAPL (ft below MP)	LNAPL Thickness	DNAPL thickness (ft)	Groundwater Elevation LNAPL corrected (ft NAVD88)
EW-1s	6/5/2019	18:40	39.54	26.63	26.63	40.00	Trace	7.42	12.91
EW-2s	6/5/2019	16:30	42.40		29.26				13.14
EW-8s	6/5/2019	18:30	40.55		27.56	32.24		22.54	12.99
EW-10s	6/5/2019	15:20	29.59		16.31	42.38	Trace	0.41	13.28
EW-15s	6/5/2019	17:00	43.00	30.00	32.17		2.17		12.96
EW-18s	6/5/2019	18:20	40.79		27.81	44.62		Trace	12.98
EW-19s	6/5/2019	15:15	25.97		12.94				13.03
EW-23s	6/5/2019	16:45	37.64	24.81	26.35		1.54		12.80
MW-1r	6/5/2019	17:55	37.81		24.86				12.95
MW-7 WC	6/5/2019	17:45	36.69		29.97				6.72
MW-10r	6/5/2019	17:45	41.85		30.84				11.01
MW-15s	6/5/2019	16:00	43.41		30.45				12.96
MW-17s	6/5/2019	17:30	41.34		28.50				12.84
MW-20i	6/5/2019	16:00	41.72	29.08	29.08	71.73	Trace	3.25	12.64
MW-22i	6/5/2019	17:50	42.34		29.00	51.46		7.56	13.34
MW-23d	6/5/2019	17:25	40.81		35.30				5.51
MW-32i	6/5/2019	16:45	39.45		28.57				10.88
MW-34i	6/5/2019	17:40	32.82		20.55				12.27
MW-35r	6/5/2019	--	32.27	--	NM[1]	--	--	--	NM
MW-36d	6/5/2019	16:18	30.59		18.16				12.43
MW-36i	6/5/2019	16:14	30.30		17.84				12.46
MW-36s	6/5/2019	16:09	30.62		17.91				12.71
MW-37d	6/5/2019	16:29	26.19		13.85				12.34
MW-37i	6/5/2019	16:37	26.07		13.69				12.38
MW-37s	6/5/2019	16:26	24.98		12.08				12.90
MW-38d	6/5/2019	17:20	31.96		19.60				12.36
MW-38i	6/5/2019	17:14	32.15		19.69				12.46
MW-38s	6/5/2019	17:10	32.41		19.47				12.94
MW-39d	6/5/2019	17:02	29.93		17.56				12.37
MW-39i	6/5/2019	16:56	30.18		17.83				12.35
MW-39s	6/5/2019	16:50	29.88		16.80				13.08
MW-40d	6/5/2019	17:42	28.81		16.49				12.32
MW-40i	6/5/2019	17:37	28.92		16.39				12.53
MW-40s	6/5/2019	17:34	28.53		15.42				13.11
MW-41d	6/5/2019	17:52	27.56		15.26				12.30
MW-41i	6/5/2019	17:49	27.22		14.90				12.32
MW-41s	6/5/2019	17:46	27.96		14.83				13.13
MW-42d	6/5/2019	18:13	32.26		20.03				12.23
MW-42i	6/5/2019	18:10	32.67		20.48				12.19
MW-42s	6/5/2019	18:07	32.42		19.42				13.00
MW-43d	6/5/2019	18:20	28.57		16.12				12.45
MW-43i	6/5/2019	18:25	30.49		18.14				12.35
MW-43s	6/5/2019	18:29	31.24		18.37				12.87
MW-44d	6/5/2019	18:41	29.55		17.03				12.52
MW-44i	6/5/2019	18:48	29.47		17.18				12.29
MW-44s	6/5/2019	18:45	29.90		16.80				13.10
MW-45d	6/5/2019	18:56	28.12		15.56				12.56
MW-45i	6/5/2019	19:00	28.05		15.68				12.37
MW-45s	6/5/2019	18:51	28.20		15.30				12.90
MW-46s	6/5/2019	19:10	35.51		22.65				12.86
MW-47s	6/5/2019	19:10	35.56		22.48				13.08
MW-48s	6/5/2019	19:19	38.58		25.43				13.15
MW-49s	6/5/2019	19:21	37.61		19.69				17.92
MW-50s	6/5/2019	17:20	39.12		26.13				12.99
MW-51s	6/5/2019	17:15	39.54		21.97				17.57
MW-52s	6/5/2019	16:39	40.70		27.89				12.81
MW-53s	6/5/2019	16:35	40.42		23.58				16.84

Table 4-1: Groundwater and NAPL Elevations: June 5, 2019
2019 O&M Annual Report
McCormick and Baxter Superfund Site

Well ID	Date	Time	Measuring Point Elevation (ft NAVD88)	Depth to LNAPL (ft below MP)	Depth to water (ft below MP)	Depth to DNAPL (ft below MP)	LNAPL Thickness	DNAPL thickness (ft)	Groundwater Elevation LNAPL corrected (ft NAVD88)
MW-54s	6/5/2019	16:20	41.78		28.95				12.83
MW-55s	6/5/2019	16:25	41.09		26.15				14.94
MW-56s	6/5/2019	17:30	43.45		30.51				12.94
MW-57s	6/5/2019	16:10	42.01		28.80				13.21
MW-58d	6/5/2019	18:00	41.43		29.20				12.23
MW-58i	6/5/2019	18:15	40.99		28.90				12.09
MW-58s	6/5/2019	18:05	41.51		28.97				12.54
MW-59s	6/5/2019	19:20	35.85		19.95				15.90
MW-60d	6/5/2019	15:56	40.18		27.75				12.43
MW-61s	6/5/2019	18:30	43.65		28.68				14.97
MW-62i	6/5/2019	17:35	42.73		30.53				12.20
MW-As	6/5/2019	16:49	39.32		21.95				17.37
MW-Ds	6/5/2019	16:15	43.26	30.04	30.04	36.19	Trace	2.83	13.22
MW-Gs	6/5/2019	15:25	40.27	27.15	27.15	43.54	Trace	1.25	13.12
MW-Os	6/5/2019	17:10	40.96		23.75				17.21
PW-1d	6/5/2019	17:00	44.05		31.30				12.75
PW-2d	6/5/2019	17:05	41.83		29.03				12.80

Notes:

LNAPL specific gravity estimated as 0.981 g/cm^3

Corrected groundwater elevation = [LNAPL thickness * LNAPL specific gravity] + groundwater elevation

[1] MW-35r was not monitored due to the need for special tools to access the monitoring point

DNAPL = dense non-aqueous phase liquid

ft = foot or feet

g/cm^3 = gram per cubic centimeter

LNAPL = light non-aqueous phase liquid

MP = measuring point

NAVD88 = North American Vertical Datum of 1988

NM = not measured

Table 4-2: Groundwater and NAPL Elevations: September 12, 2019
2019 O&M Annual Report
McCormick and Baxter Superfund Site

Well ID	Date	Time	Measuring Point Elevation (ft NAVD88)	Depth to LNAPL (ft below MP)	Depth to water (ft below MP)	Depth to DNAPL (ft below MP)	LNAPL Thickness	DNAPL thickness (ft)	Groundwater Elevation LNAPL corrected (ft NAVD88)
EW-1s	9/12/2019	13:22	39.54		27.59	43.85		3.57	11.95
EW-2s	9/12/2019	10:53	42.40		34.35				8.05
EW-8s	9/12/2019	12:44	40.55		28.76	53.09		1.69	11.79
EW-10s	9/12/2019	11:56	29.59		22.27	41.43		1.36	7.32
EW-15s	9/12/2019	12:18	43.00	32.12	45.30		13.18		10.63
EW-18s	9/12/2019	13:05	40.79		29.04	43.00		1.71	11.75
EW-19s	9/12/2019	12:04	25.97		18.34				7.63
EW-23s	9/12/2019	11:28	37.64	28.04	33.10		5.06		9.50
MW-1r	9/12/2019	15:07	37.81		27.54				10.27
MW-7 WC	9/12/2019	14:55	36.69		26.64				10.05
MW-10r	9/12/2019	13:40	41.85		31.92				9.93
MW-15s	9/12/2019	16:43	43.41		31.88				11.53
MW-17s	9/12/2019	16:41	41.34		30.12				11.22
MW-20i	9/12/2019	11:25	41.72		34.71	70.22		4.75	7.01
MW-22i	9/12/2019	13:51	42.34		33.00	52.54		6.48	9.34
MW-23d	9/12/2019	16:31	40.81		33.12				7.69
MW-32i	9/12/2019	15:26	39.45		26.29				13.16
MW-34i	9/12/2019	12:49	32.82		26.63				6.19
MW-35r	9/12/2019	--	32.27	--	NM[1]	--	--	--	NM
MW-36d	9/12/2019	11:21	30.59		23.71				6.88
MW-36i	9/12/2019	11:29	30.30	23.36	23.36		Trace		6.94
MW-36s	9/12/2019	11:37	30.62		20.95				9.67
MW-37d	9/12/2019	11:12	26.19		19.33				6.86
MW-37i	9/12/2019	11:08	26.07		19.08				6.99
MW-37s	9/12/2019	10:58	24.98		17.33				7.65
MW-38d	9/12/2019	12:23	31.96	25.32	25.32		Trace		6.64
MW-38i	9/12/2019	12:16	32.15	25.03	25.03		Trace		7.12
MW-38s	9/12/2019	12:10	32.41	22.38	22.38		Trace		10.03
MW-39d	9/12/2019	11:50	29.93	23.13	23.13		Trace		6.80
MW-39i	9/12/2019	11:57	30.18	23.44	23.44		Trace		6.74
MW-39s	9/12/2019	12:05	29.88	22.05	22.05		Trace		7.83
MW-40d	9/12/2019	12:43	28.81		22.26				6.55
MW-40i	9/12/2019	12:49	28.92	21.89	21.89		Trace		7.03
MW-40s	9/12/2019	12:55	28.53	18.21	18.21		Trace		10.32
MW-41d	9/12/2019	13:13	27.56		21.16				6.40
MW-41i	9/12/2019	13:07	27.22		20.71				6.51
MW-41s	9/12/2019	13:02	27.96		20.27				7.69
MW-42d	9/12/2019	13:35	32.26	25.98	25.98		Trace		6.28
MW-42i	9/12/2019	13:30	32.67	26.27	26.27		Trace		6.40
MW-42s	9/12/2019	13:24	32.42		20.90				11.52
MW-43d	9/12/2019	13:43	28.57	22.11	22.11		Trace		6.46
MW-43i	9/12/2019	13:49	30.49		24.06				6.43
MW-43s	9/12/2019	13:54	31.24	23.94	23.94		Trace		7.30
MW-44d	9/12/2019	16:45	29.55		21.62				7.93
MW-44i	9/12/2019	14:14	29.47		22.60				6.87
MW-44s	9/12/2019	16:41	29.90		17.93				11.97
MW-45d	9/12/2019	16:32	28.12		20.42				7.70
MW-45i	9/12/2019	14:18	28.05	21.53	21.53		Trace		6.52
MW-45s	9/12/2019	16:37	28.20		20.82				7.38
MW-46s	9/12/2019	15:32	35.51	23.71	23.71		Trace		11.80
MW-47s	9/12/2019	15:37	35.56	27.84	27.84		Trace		7.72
MW-48s	9/12/2019	15:21	38.58	25.98	25.98		Trace		12.60
MW-49s	9/12/2019	15:11	37.61	21.71	21.71		Trace		15.90
MW-50s	9/12/2019	16:00	39.12		26.79				12.33
MW-51s	9/12/2019	16:09	39.54		23.69				15.85
MW-52s	9/12/2019	15:51	40.70		29.00				11.70
MW-53s	9/12/2019	15:56	40.42		25.52				14.90

Table 4-2: Groundwater and NAPL Elevations: September 12, 2019
2019 O&M Annual Report
McCormick and Baxter Superfund Site

Well ID	Date	Time	Measuring Point Elevation (ft NAVD88)	Depth to LNAPL (ft below MP)	Depth to water (ft below MP)	Depth to DNAPL (ft below MP)	LNAPL Thickness	DNAPL thickness (ft)	Groundwater Elevation LNAPL corrected (ft NAVD88)
MW-54s	9/12/2019	16:30	41.78		30.09				11.69
MW-55s	9/12/2019	16:22	41.09		29.08				12.01
MW-56s	9/12/2019	14:00	43.45		33.03				10.42
MW-57s	9/12/2019	16:35	42.01		33.36				8.65
MW-58d	9/12/2019	14:40	41.43		35.14				6.29
MW-58i	9/12/2019	14:21	40.99		35.06				5.93
MW-58s	9/12/2019	14:35	41.51		33.74				7.77
MW-59s	9/12/2019	15:21	35.67		22.93				12.74
MW-60d	9/12/2019	15:50	40.18		33.20				6.98
MW-61s	9/12/2019	--	43.65	--	NM[2]	--	--	--	NM
MW-62i	9/12/2019	16:53	42.73		34.73				8.00
MW-As	9/12/2019	15:32	39.32		23.35				15.97
MW-Ds	9/12/2019	11:05	43.26		34.79	36.08		2.94	8.47
MW-Gs	9/12/2019	11:32	40.27		32.42	42.08		2.71	7.85
MW-Os	9/12/2019	15:45	40.96		25.13				15.83
PW-1d	9/12/2019	15:33	44.05		33.17				10.88
PW-2d	9/12/2019	15:52	41.83		31.65				10.18

Notes:

LNAPL specific gravity estimated as 0.981 g/cm^3

Corrected groundwater elevation = [LNAPL thickness * LNAPL specific gravity] + groundwater elevation

[1] MW-35r was not monitored due to the need for special tools to access the monitoring point

[2] MW-61s was not monitored inadvertently

DNAPL = dense non-aqueous phase liquid

ft = foot or feet

g/cm^3 = gram per cubic centimeter

LNAPL = light non-aqueous phase liquid

MP = measuring point

NAVD88 = North American Vertical Datum of 1988

NM = not measured

Table 4-3: Groundwater O&M Activities in 2019
2019 O&M Annual Report
McCormick and Baxter Superfund Site

O&M Activity	Frequency in 2019
NAPL Monitoring:	
Manual gauging of site wells	June, September
Groundwater Monitoring:	
Downloading continuous water level data from transducers	June, September
Manual water level measurements from site wells	June, September
Routine Maintenance of Equipment:	
Transducers	June, September
Non-Routine Maintenance:	
Monitoring well network inspection and maintenance	March, May
Changed batteries in transducers (as needed)	June, September

Table 5-1: Noxious Weeds Identified in 2019
2019 O&M Annual Report
McCormick and Baxter Superfund Site

Species	Common Name	Weed Class	Area Present	Percent Treated	Comments
Ailanthus altissima	Tree of heaven	B	U, EC	100	Large tree cut down and stump treated - this was seeding other areas; smaller saplings treated
Amorpha fruticosa	Indigo bush	B	LR	100	Occasional shrub; all plants sprayed - seems to be successful
Buddleja davidii	Butterflybush	B	LR, SW	100	Two large plants; sprayed and killed
Centaurea diffusa	Diffuse knapweed	B	UR	50	Mainly along fence; pulled and spayed
Centaurea stoebe	Spotted knapweed	B	UR, EC, IC	50	Scattered; sprayed and pulled - spraying was fair to good in killing species
Cirsium arvense	Canada thistle	B	LR, EC, IC	60	Sprayed; very good kill rate
Cirsium vulgare	Bull thistle	B	LR, EC, IC	70	Sprayed; very good kill rate
Chondrilla juncea	skeletonweed	B	IC, EC	30	Sprayed when found while spraying other species, not a very aggressive species
Cytisus scoparius	Scotch broom	B	U, SW, UR, EC	100	Very invasive; large patches along perimeter fence sprayed and killed. Many individual scattered plants killed
Geranium lucidum	Shiny leaf geranium	B	LR	10	Annual growing in blocks along river; small section pulled up
Hypericum perforatum	Common St. Johns-wort	B	UR	50	Occasional to patchy; several patches sprayed with fair to good kill rate
Rubus armeniacus	Himalayan blackberry	B	U, EC, UR	95	Very invasive; large patches along perimeter fence sprayed and killed. Many individual scattered plants killed
Senecio jacobaea	Tansy ragwort	B	UR, EC	100	Very little, sprayed and killed successfully
Taeniatherum caput-medusae	Medusahead rye	B	IC, EC, U	0	Winter annual grass; best controlled by fire or intense grazing; control not attempted
Tanacetum vulgare	Tansy	none	UR	100	Large patch sprayed; effort seems to have been ineffective

Notes:
EC = Earthen Cap
IC = Impermeable Cap
U = other upland areas (fence lines, parking area)
SW = Stormwater Retention Pond
UR = Upper Riparian Area
LR = Lower Riparian Area

Table 7-1: Soil Cap O&M Activities Planned through 2024
2019 O&M Annual Report
McCormick and Baxter Superfund Site

O&M Activity	Frequency
Visual Inspections:	
Cap surface	Quarterly
Subsidence near EW-1s	Quarterly
Stormwater conveyance system	Quarterly
Security fencing	Quarterly
Warning signs	Quarterly
Abundance and survival of vegetation	Quarterly
Routine Maintenance and Monitoring:	
Manual removal of invasive plants	Semiannually, if necessary
Targeted application of herbicides	Semiannually, if necessary
Non-Routine Maintenance:	
Repairs of fence	As needed
Replacement of warning signs	As needed
Repairs of gravel roads	As needed
Filling of potential animal burrow into the earthen cap	As needed
Removing sediments from manholes	As needed
Irrigation	As needed
Replanting unsuccessful trees and shrubs	As needed
Utilities Service:	
Water, electric, and solid waste	Continuous

Table 7-2: Sediment Cap O&M Activities Planned through 2024
2019 O&M Annual Report
McCormick and Baxter Superfund Site

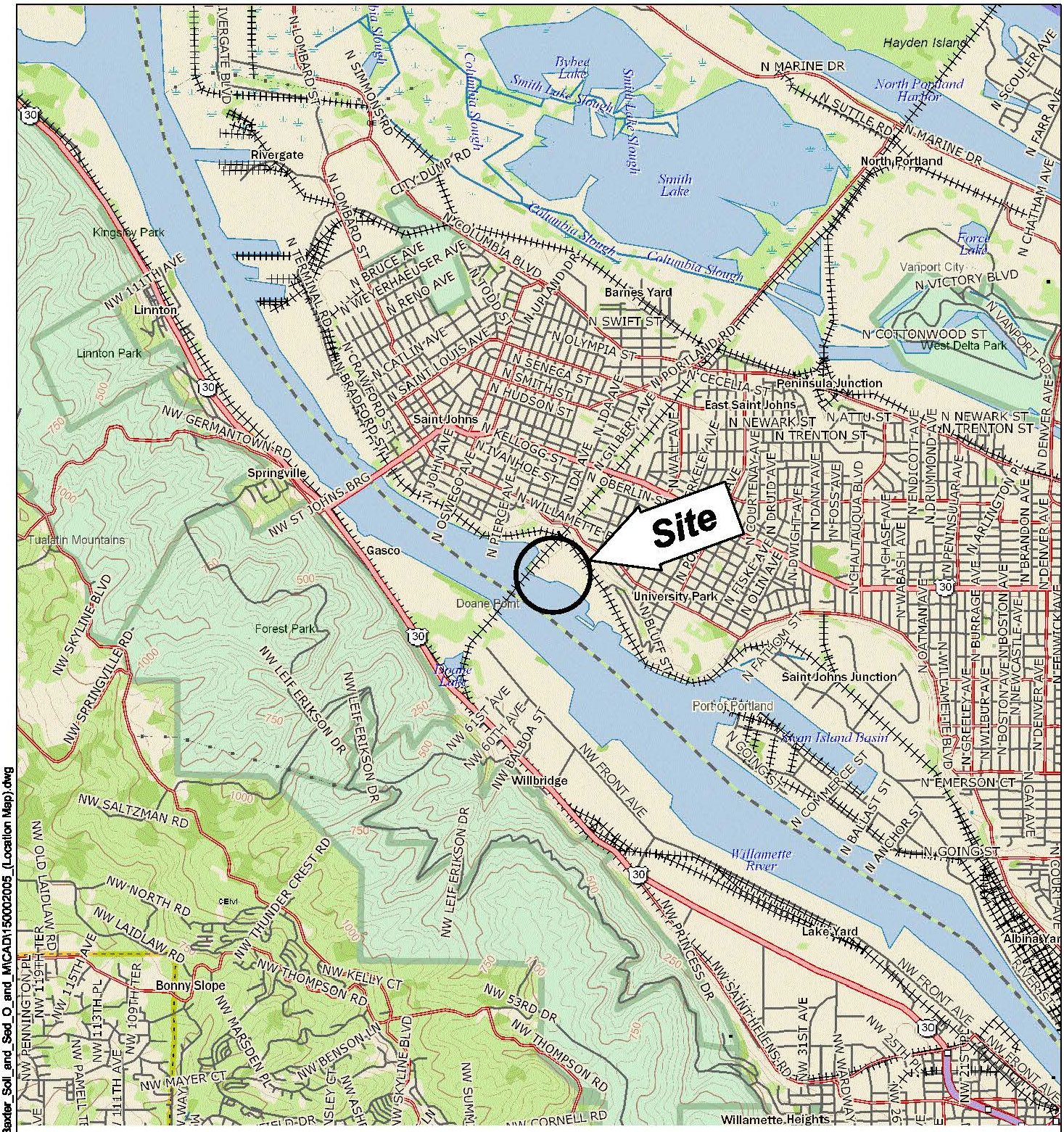
O&M Activity	Frequency
Visual Inspections (from shore):	
Warning buoys	Quarterly
Cap surface	Quarterly
Habitat quality	Annually
Routine Monitoring:	
Water column and inter-armoring water sampling	Every 5 years (next event in 2020)
Organoclay core sampling	Not anticipated in 2020; additional sampling will be reconsidered during subsequent Five Year Reviews.
Non-Routine Monitoring:	
Multibeam bathymetric surveys, side-scan sonar survey	After unforeseen natural event, if needed; Every 10 years, starting in 2020
Diver inspection	Every 10 years, starting in 2020; after bathymetry, if necessary
Non-Routine Maintenance:	
Replacement of buoys	As needed
Additional armoring placement	After unforeseen natural event, if needed; Schedule for 2020, if needed
Additional organoclay capping	As needed
Articulated concrete block grouting or armoring void space maintenance (habitat gravel)	Every 5 years , or as needed based on site inspections

Table 7-3: Groundwater O&M Activities Planned through 2024
2018 O&M Annual Report
McCormick and Baxter Superfund Site

O&M Activity	Frequency
NAPL Monitoring:	
Manual gauging of site wells	Semiannually
Manual extraction from exterior wells	Not recommended
Groundwater Monitoring:	
Downloading continuous water level data from transducers	Semiannually
Manual water level measurements from site wells	Semiannually
Groundwater Sampling:	
Site-wide	2020, Subsequent frequency to be determined
Infiltration pond (MW-59s)	Fall 2020 (every 5 years)
Routine Maintenance of Equipment:	
Interface probes, pumps, vehicle, data loggers / transducers, etc.	As needed

Note:
NAPL = non-aqueous phase liquid

FIGURES



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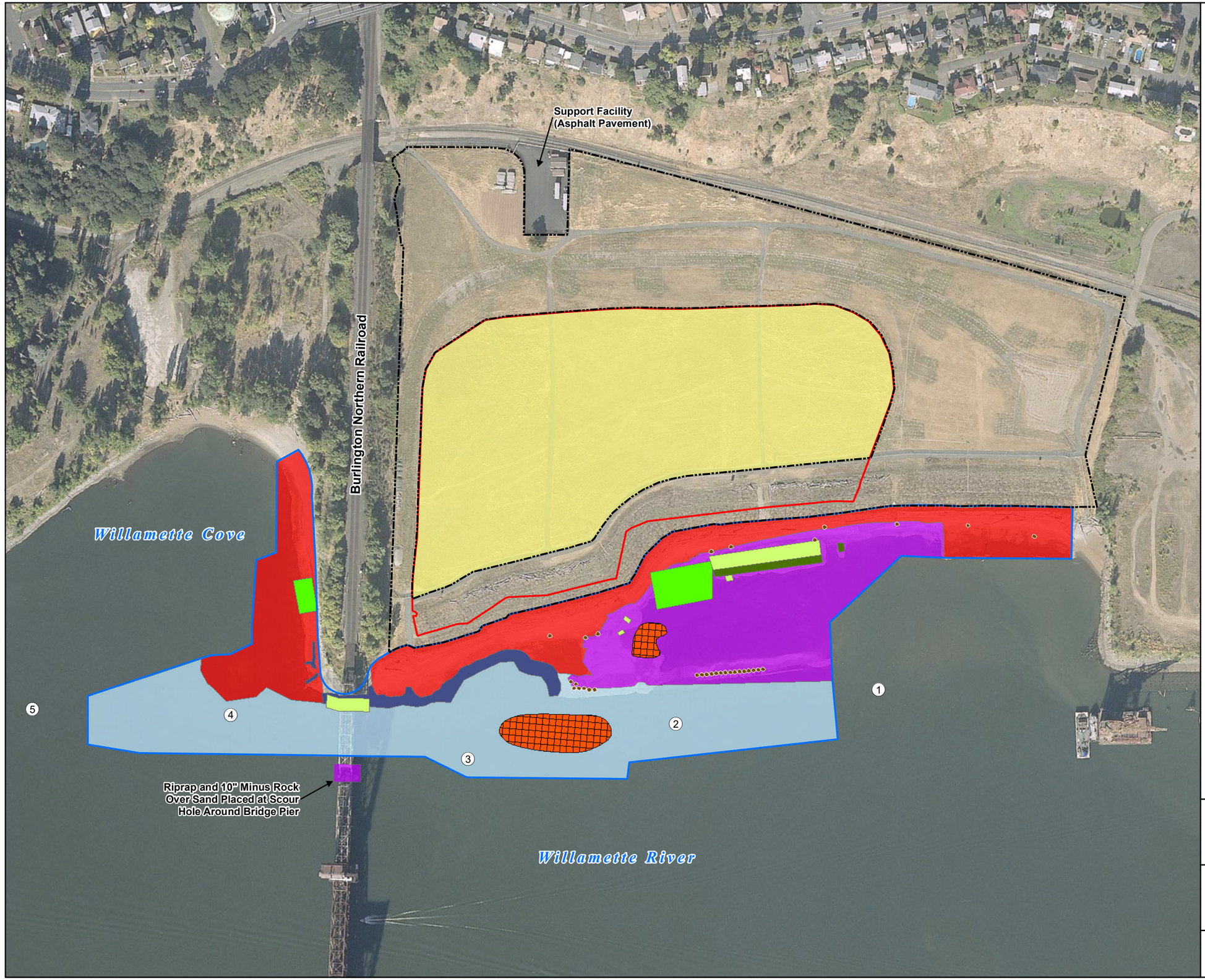

LEGEND

- Subsurface Barrier Wall
- Sediment Cap Boundary
- Granular Organophilic Clay
- Organoclay™ Reactive Core Mats (Double)
- Organoclay™ Reactive Core Mats (Single)
- Thickened Sand Layer
- Boulder Clusters
- Buoy Locations
- Riprap Armor
- Articulated Concrete Block
- 6-inch Minus Rock Armor
- 10-inch Minus Rock Armor
- Impermeable Cap
- Earthen Soil Cap Boundary

NOTE:
Aerial photo taken on September 22, 2006.

0 250 500
Scale in feet

McCormick & Baxter Superfund Site
Portland, Oregon

Current Site Layout and Features

03/20

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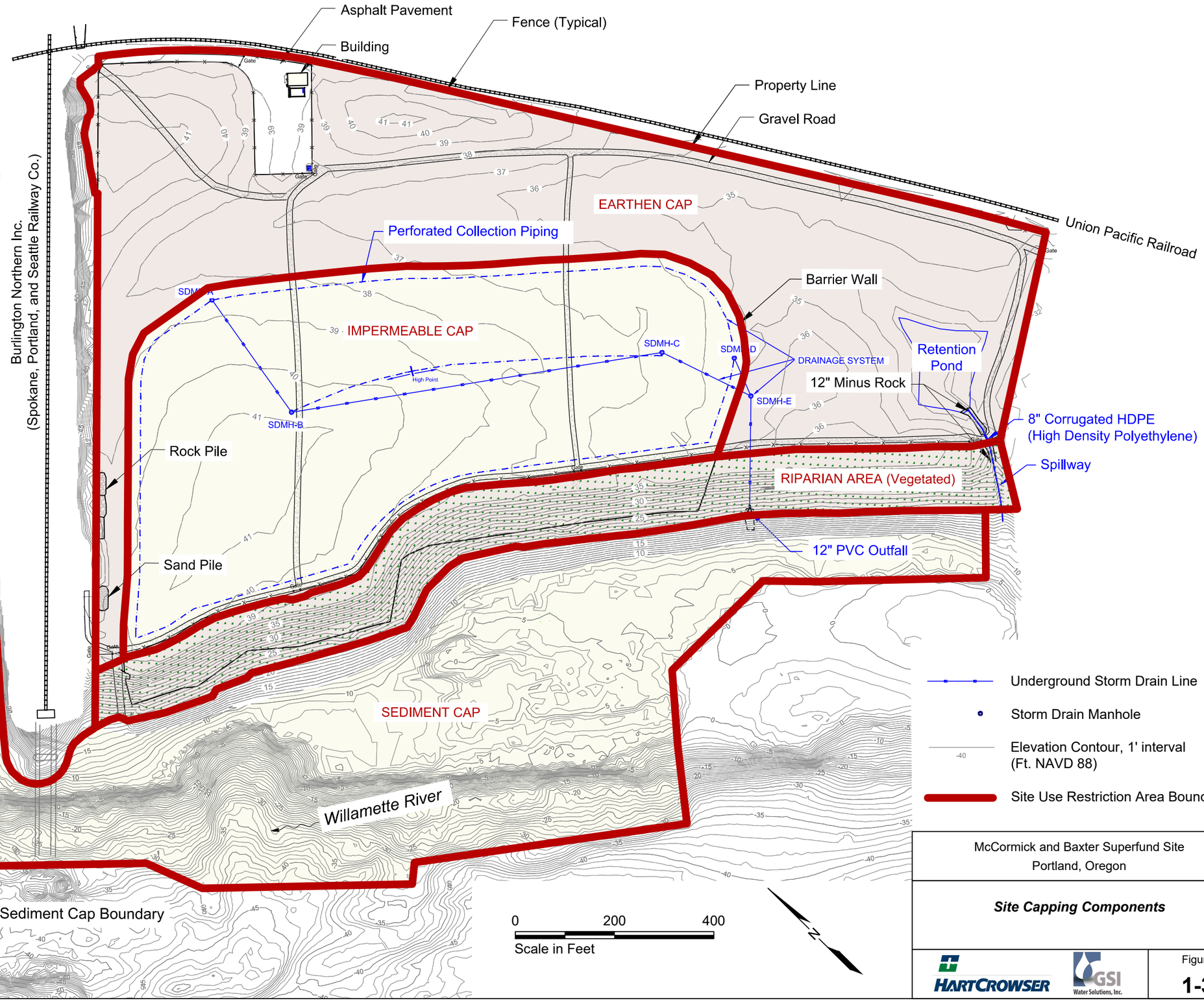
Figure
1-2

NOTES:

1. Bathymetric survey conducted by David Evans and Associates, Inc., 04/26/2006.
2. Upland site survey resurveyed and replaced by Westlake Consultants, 09/18/2019.
3. Horizontal Datum: North American Datum of 1983 - 91 adj. (NAD83/91), State Plane Coordinate System, Oregon North Zone. Units: International Feet.
4. Vertical Datum: North American Vertical Datum of 1988 (NAVD 88)
5. Contour Interval: One-Foot. Bathymetric contours were derived from a Digital Terrain Model based on a 3-foot grid of multibeam data.
6. Additional rock was placed at the 6" minus rock placement areas on 06/26/2007. These areas have not been surveyed and the contours of this figure do not reflect the additional rock placement.



McCormick and Baxter Superfund Site
Portland, Oregon

Site Capping Components

03/20

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Figure
1-3

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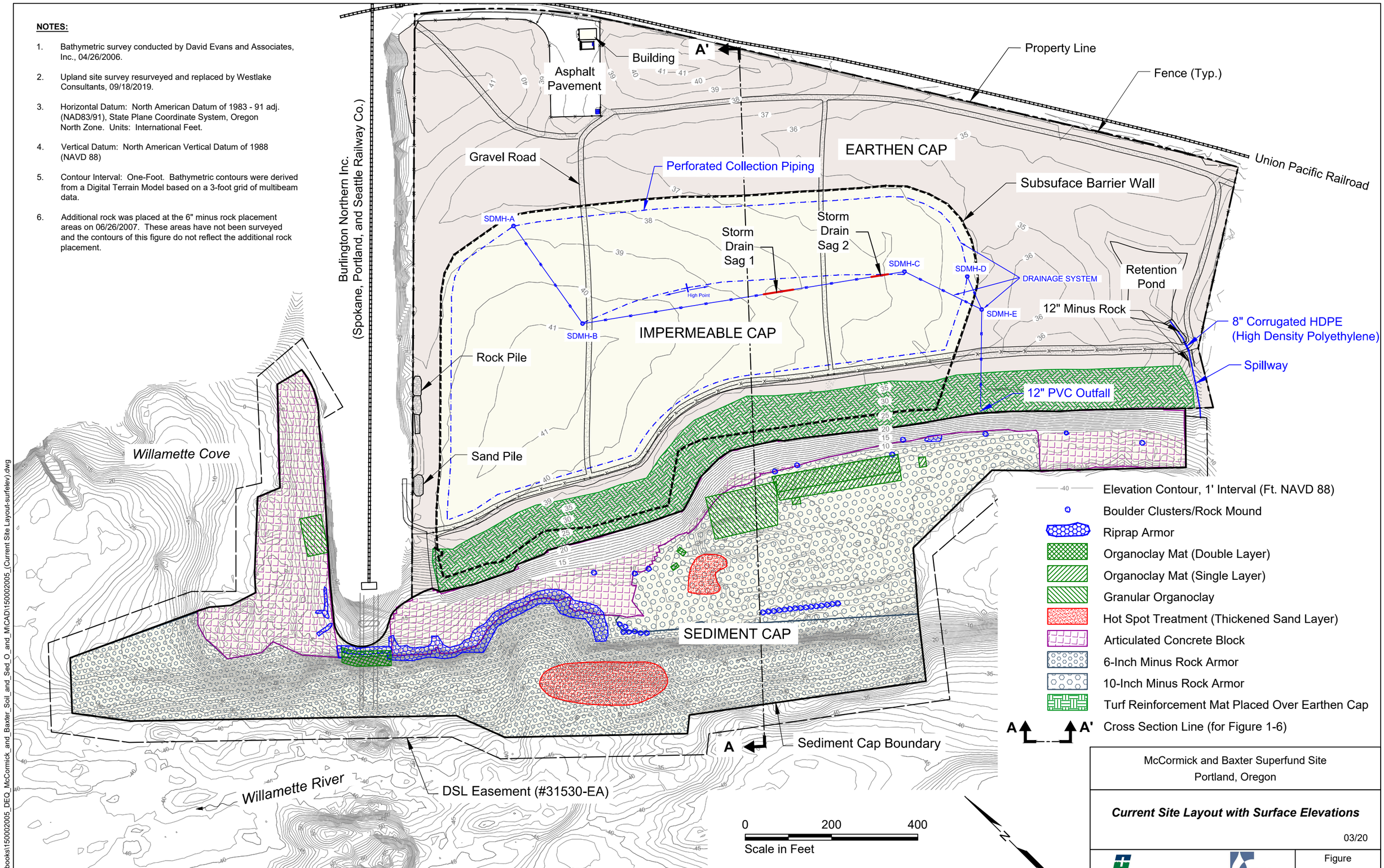
NOTES:

1. Bathymetric survey conducted by David Evans and Associates, Inc., 04/26/2006.
2. Upland site survey resurveyed and replaced by Westlake Consultants, 09/18/2019.
3. Horizontal Datum: North American Datum of 1983 - 91 adj. (NAD83/91), State Plane Coordinate System, Oregon North Zone. Units: International Feet.
4. Vertical Datum: North American Vertical Datum of 1988 (NAVD 88)
5. Contour Interval: One-Foot. Bathymetric contours were derived from a Digital Terrain Model based on a 3-foot grid of multibeam data.
6. Additional rock was placed at the 6" minus rock placement areas on 06/26/2007. These areas have not been surveyed and the contours of this figure do not reflect the additional rock placement.



McCormick and Baxter Superfund Site
Portland, Oregon

Current Site Layout with Surface Elevations

03/20

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Figure
1-4

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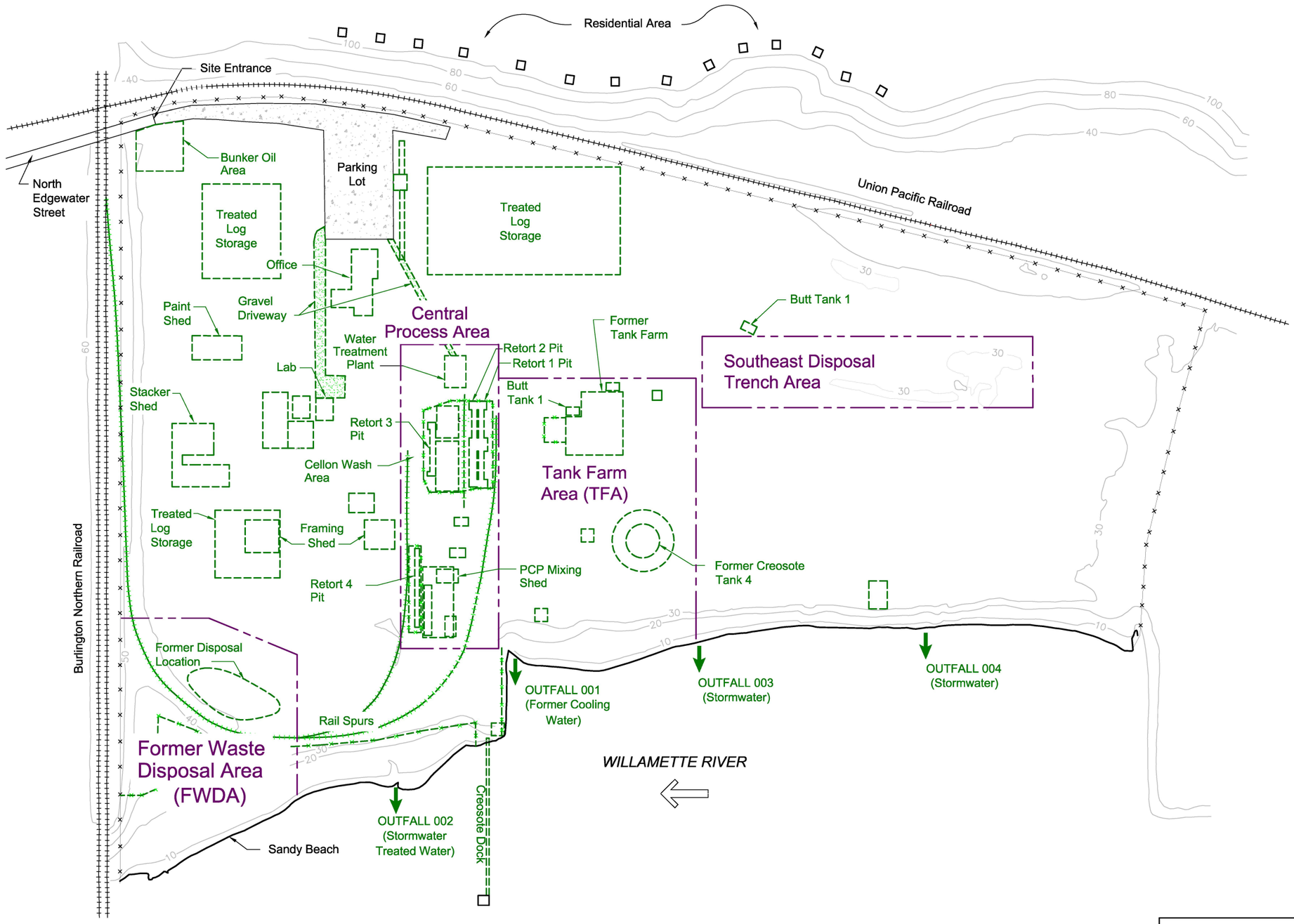

McCormick and Baxter Superfund Site
Portland, Oregon

Historical Contaminant Source Areas

03/20

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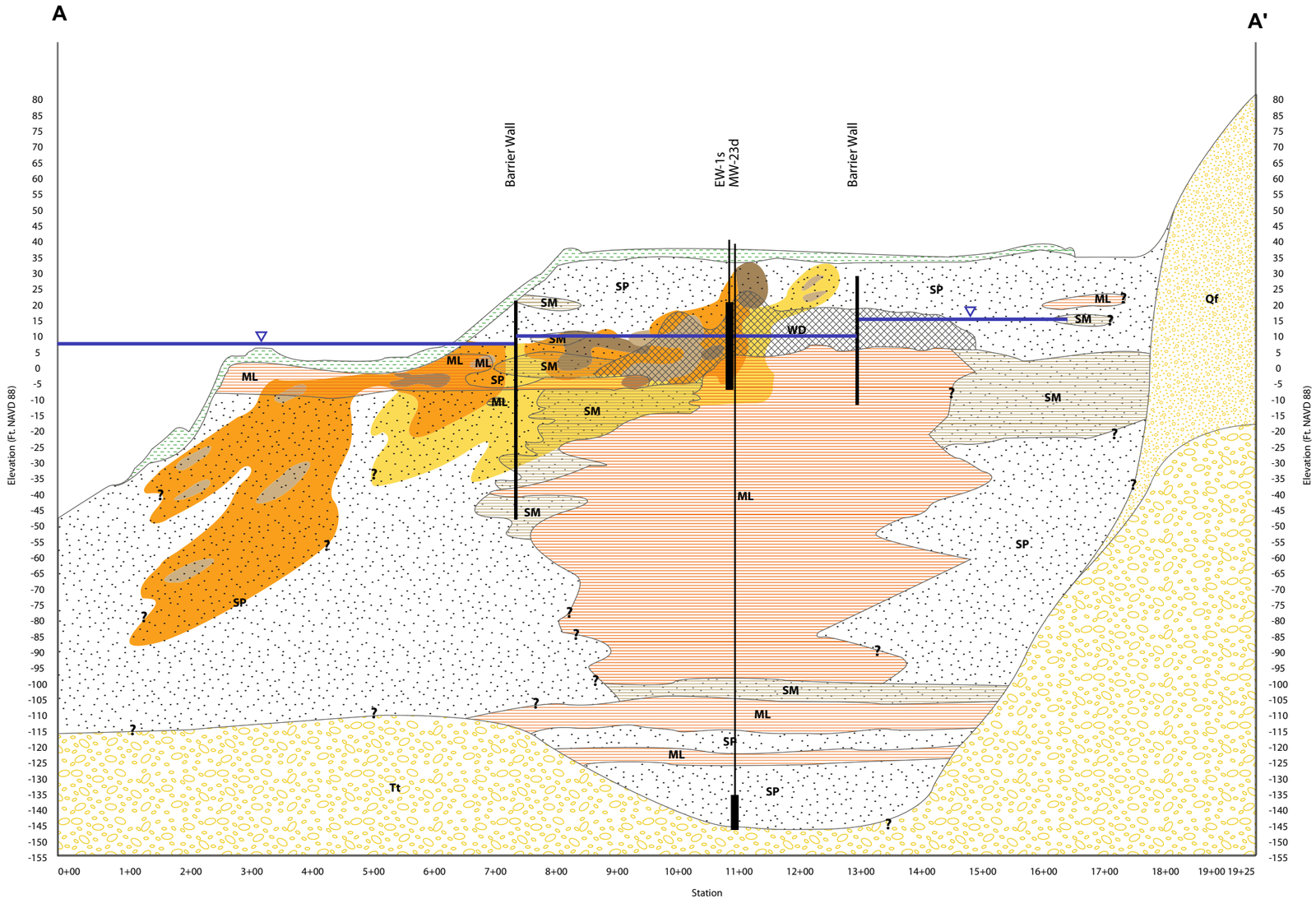
Figure
1-5

F:\Notebooks\150002005_DEQ_McCormick_and_Baxter_Soil_and_Sed_O_and_MICAD\150002005_(Historic Contamination).dwg



LEGEND

- SP- Sand, Fine to Medium, Poorly Graded
- SM- Silt Sand, or Thin Interbeds of Silt and Sand
- ML- Clayey Silt or Silty Clay
- WD- Wood Debris, Chips or Sawdust Occasionally
- Qf- Catastrophic Flood Deposits Consisteing of Gravels and Sands
- Tt- Troutdale Formation
- Sediment/Soil Cap
- Approximate Average Water Level 2008
- Creosote Odor
- Strong Creosote Odor
- Heavy Sheen
- Saturated

NOTE: Refer to Figure 1-4 for Plan View of Cross Section Location.

Horizontal Scale in Feet
0 200 400
0 40 80
Vertical Scale in Feet
Vertical Exaggeration = 5x

McCormick and Baxter Superfund Site
Portland, Oregon

Historical NAPL Distribution Cross Section

03/20

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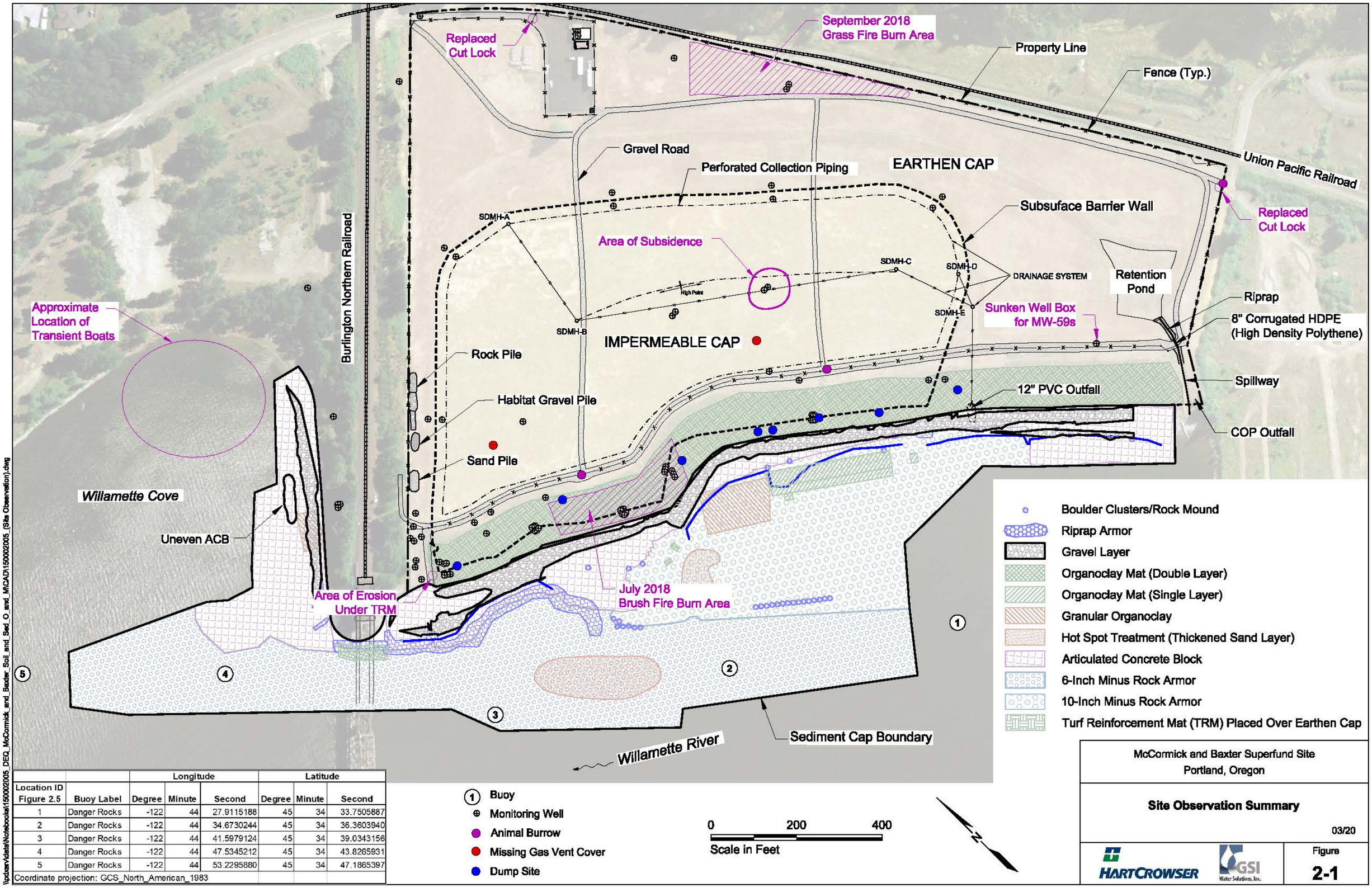
Figure
1-6

F:\Notebooks\1567010_DEQ McCormick & Baxter O&M\CAD\1567010_(NAPL X-Sect).pdf



		Longitude			Latitude		
Location ID Figure 2.5	Buoy Label	Degree	Minute	Second	Degree	Minute	Second
1	Danger Rocks	-122	44	27.9115188	45	34	33.7505887
2	Danger Rocks	-122	44	34.6730244	45	34	36.3603940
3	Danger Rocks	-122	44	41.5979124	45	34	39.0343156
4	Danger Rocks	-122	44	47.5345212	45	34	43.8265931
5	Danger Rocks	-122	44	53.2295880	45	34	47.1865397
Coordinate projection: GCS_North_American_1983							

McCormick and Baxter Superfund Site
Portland, Oregon

Site Observation Summary

03/20

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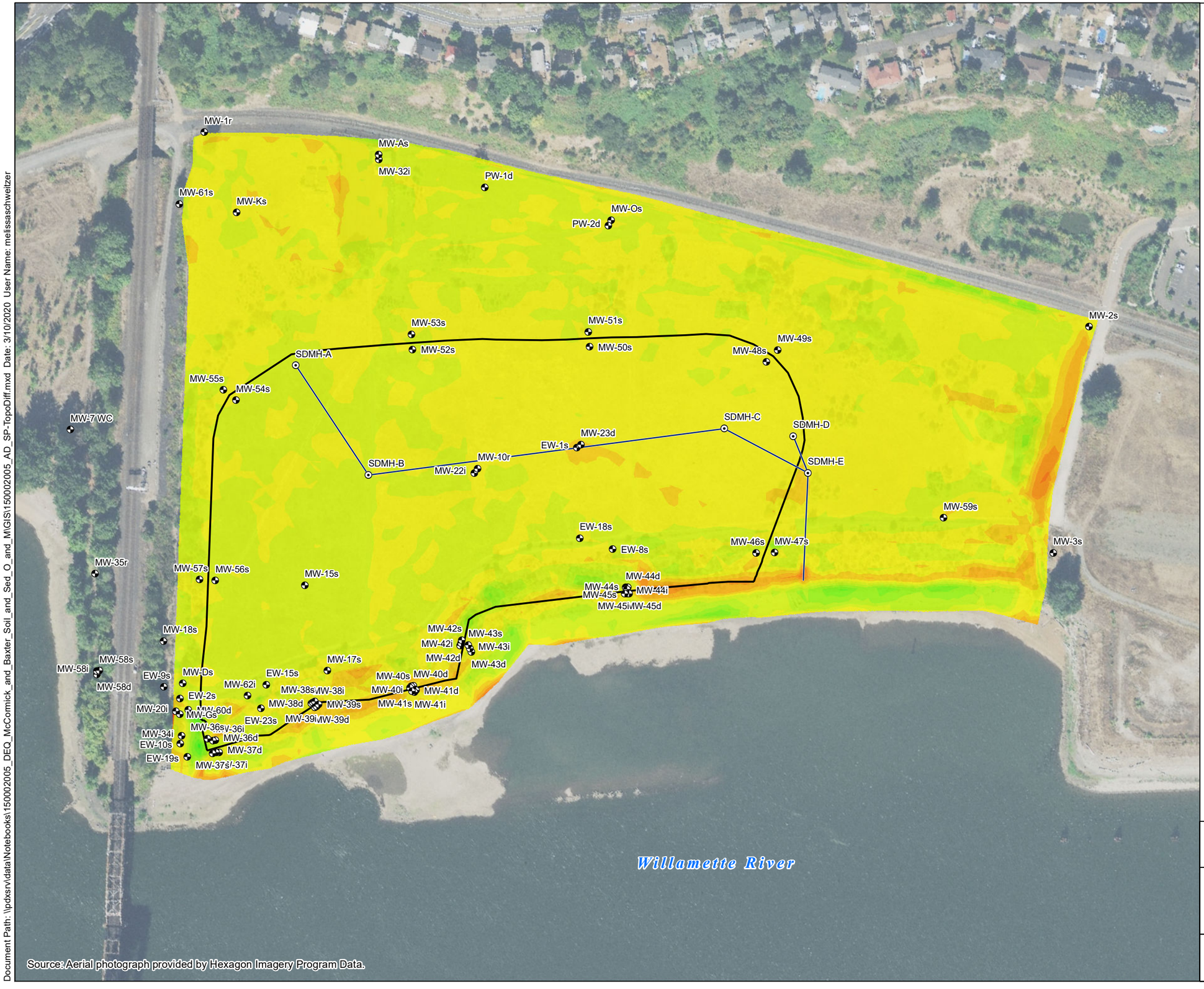
Figure
2-1

\\pdxserv\data\Notebooks\150002005_DEQ_McCormick_and_Baxter_Soil_and_Sed_O_and_M\CAD\150002005_(Site Observation).dwg



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Legend

- Groundwater Monitoring Well
- Stormwater Discharge Manhole
- Stormwater Discharge Pipeline
- Subsurface Barrier Wall

Difference in Topography from 2008 to 2019 (feet)

2.5 to 3.0	Rise
2.0 to 2.5	
1.5 to 2.0	
1.0 to 1.5	
0.5 to 1.0	
0 to 0.5	
-0.5 to 0	
-1.0 to -0.5	
-1.5 to -1.0	
-2.0 to -1.5	
-2.5 to -2.0	
-3.0 to -2.5	
-3.5 to -3.0	Drop

N

0 100 200 400 Feet

Note: Feature locations are approximate.

McCormick and Baxter Superfund Site
Portland, Oregon

Difference in Topography
Upland Cap Survey 2008 vs 2019

150-002-005 03/20

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Figure
2-2

FIGURE 4-1

Groundwater Monitoring Well Location Map

McCormick and Baxter Superfund Site
Portland, Oregon

LEGEND

- Groundwater Monitoring Well
- Groundwater Monitoring Well with Transducer
- Subsurface Barrier Wall

Date: March 2, 2020
Data Sources: Aerial photo City of Portland, 2018

0 100 200 300
Feet

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FIGURE 4-2

Groundwater Contour Map for June 5, 2019 Sampling Event

McCormick and Baxter Superfund Site
Portland, Oregon

LEGEND

- Groundwater Monitoring Well
- Groundwater Monitoring Well with Transducer
- Groundwater Elevation Contour (dashed where inferred)
- Willamette River Water Level During Sampling Event (12.18 feet)
- Subsurface Barrier Wall

NOTES

1. Elevations shown in NAVD88.
2. Aerial photo taken summer of 2018.
3. Water levels measured between 3:00 p.m. and 7:30 p.m.
4. Willamette River low tide at 4:30 p.m. River elevation: 12.18 feet NAVD88

*MW-7 WC not included in creation of groundwater elevation contours due to anomalous reading.

NM = Not Measured

Date: March 6, 2020
Data Sources: Aerial photo City of Portland, 2018

0 100 200 300
Feet

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FIGURE 4-3

Groundwater Contour Map for September 12, 2019 Sampling Event

McCormick and Baxter Superfund Site
Portland, Oregon

LEGEND

- Groundwater Monitoring Well
- Groundwater Monitoring Well with Transducer
- Groundwater Elevation Contour (dashed where inferred)
- Willamette River Water Level During Sampling Event (5.76 feet)
- Subsurface Barrier Wall

NOTES

1. Elevations shown in NAVD88.
2. Aerial photo taken summer of 2018.
3. Water levels measured between 11:00 a.m. and 5:00 p.m.
4. Willamette River low tide at 2:00 p.m. River elevation: 5.76 feet NAVD88

NM = Not Measured

Date: March 4, 2020
Data Sources: Aerial photo City of Portland, 2018

N

0 100 200 300
Feet

HARTCROWSER

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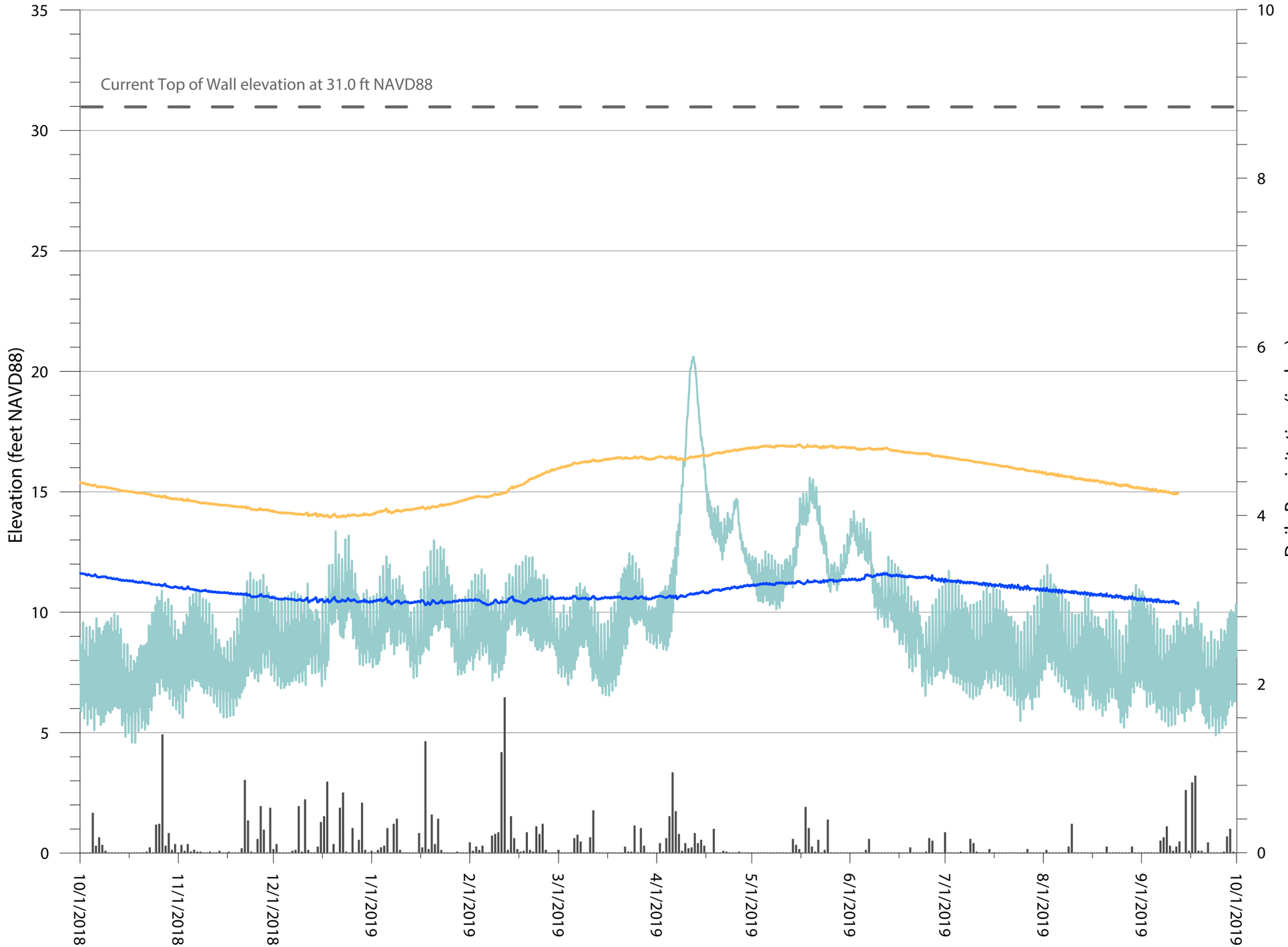

Legend

- MW-52s (Interior)
- MW-53s (Exterior)
- River
- Precipitation

Notes:
MW-52s is located inside the barrier wall and MW-53s is located outside the barrier wall.

Due to barometric pressure transducer failure, barometric pressure data from a weather station at Portland International Airport was used from 06/05/2019 - 09/12/2019. The transducer data resolution during this period was reduced to hourly readings to facilitate the use of barometric pressure data from the Portland Internation Airport weather station.

McCormick and Baxter Superfund Site
Portland, Oregon

2019 Groundwater Elevations
in Monitoring Wells MW-52s and MW-53s

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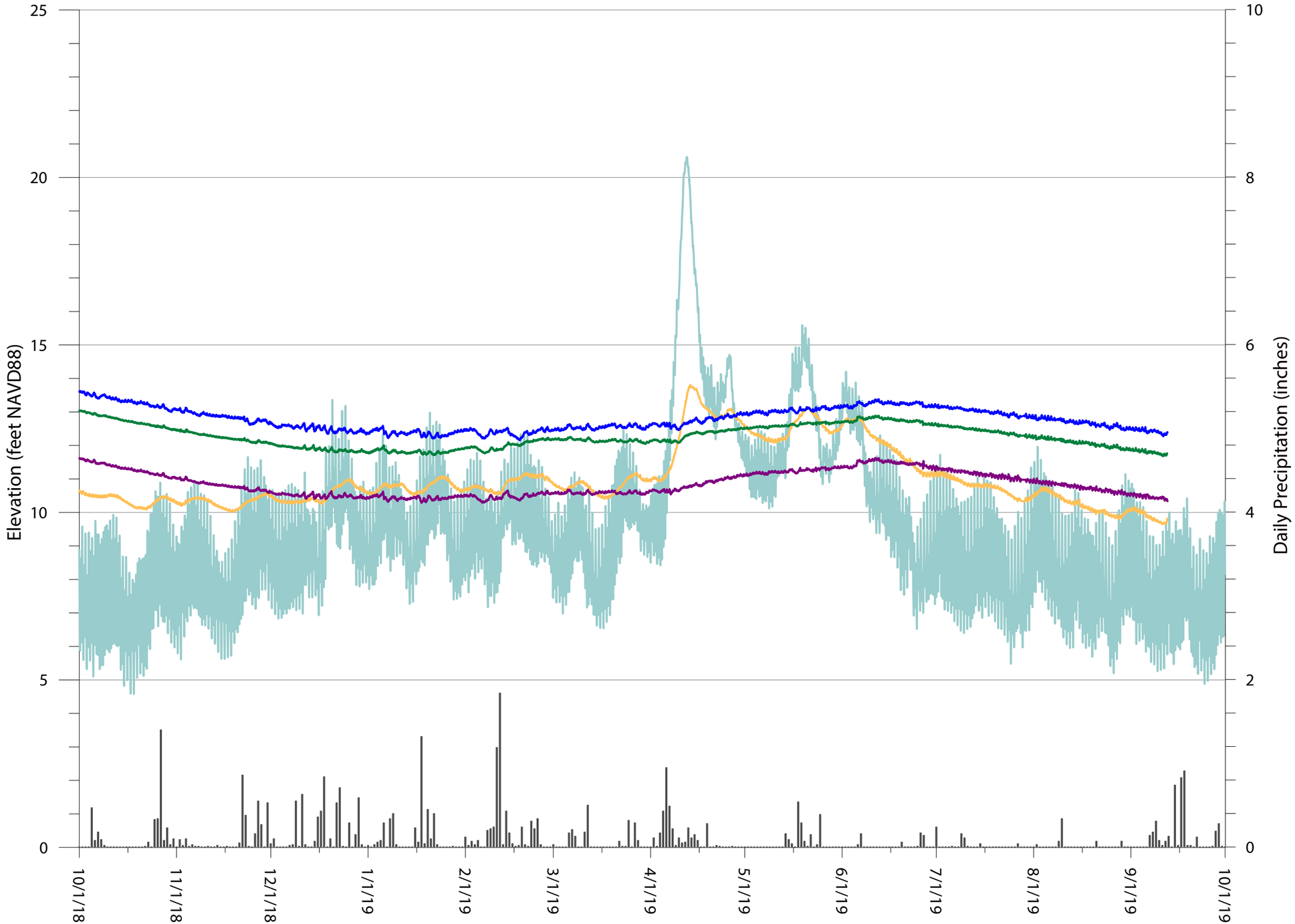
Figure
4-4



Legend

- EW-1s (Interior)
- MW-36s (Interior)
- MW-44s (Interior)
- MW-52s (Interior)
- River
- Precipitation

Notes:
Monitoring wells EW-1s, MW-36s, MW-44s, and MW-52s are located inside the barrier wall.

Due to barometric pressure transducer failure, barometric pressure data from weather station at Portland International Airport was used from 06/05/2019 - 09/12/2019. The transducer data resolution was reduced to hourly readings to facilitate the use of barometric pressure data from the Portland International Airport weather station.

McCormick and Baxter Superfund Site
Portland, Oregon

2019 Groundwater Elevations
within the Barrier Wall

HARTCROWSER

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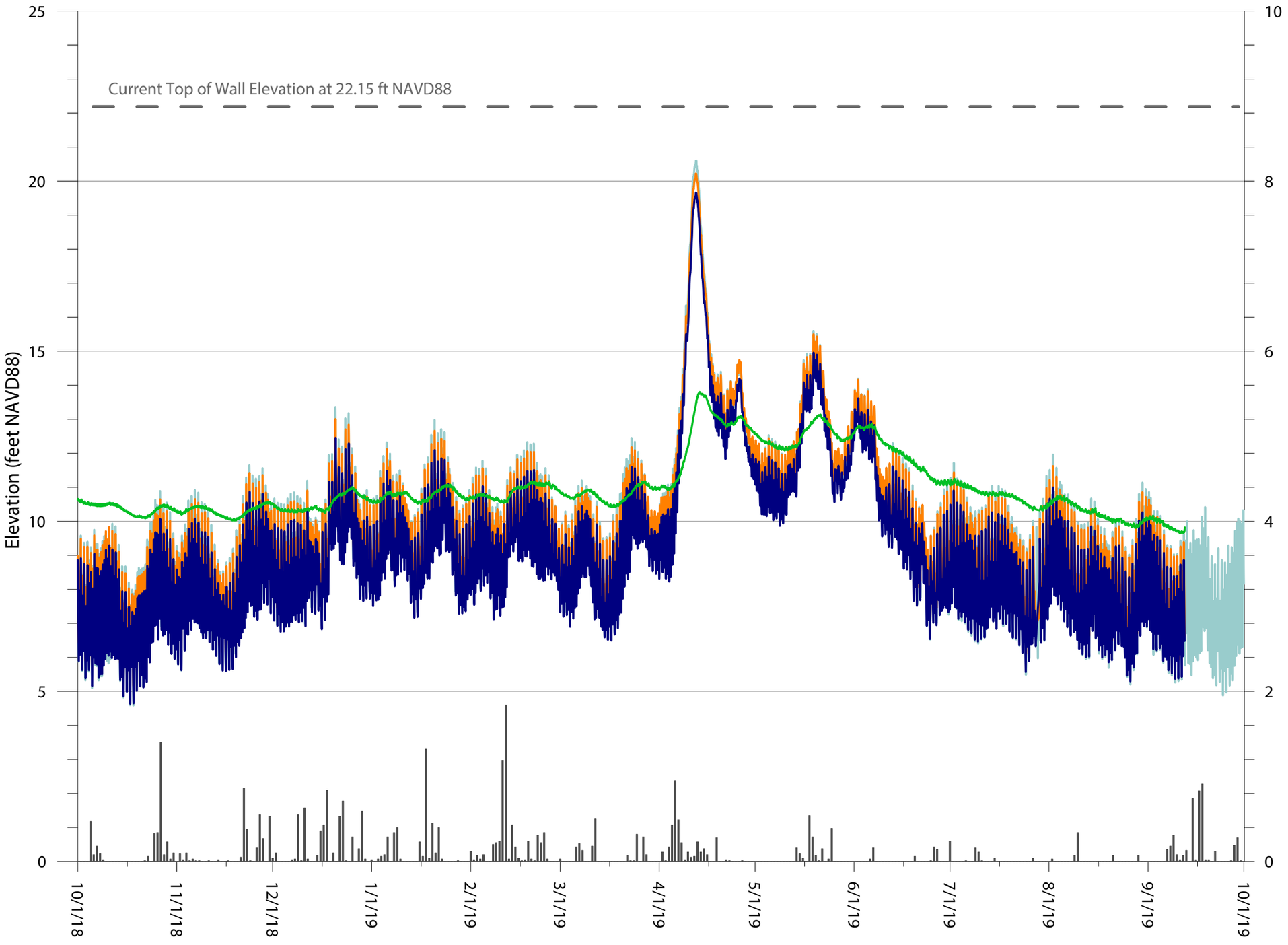
Figure
4-5



Legend

- MW-36s (Interior)
- MW-36d (Interior)
- MW-37d (Exterior)
- River
- Precipitation

Notes:
MW-36 well cluster is located inside the barrier wall and MW-37 well cluster is located outside the barrier wall.

Due to barometric pressure transducer failure, barometric pressure data from a weather station at Portland International Airport was used from 06/05/2019 - 09/12/2019. The transducer data resolution was reduced to hourly readings to facilitate the use of barometric pressure data from the Portland International Airport weather station.

*No data collected at MW-37s after September 22, 2018 due to battery failure.

McCormick and Baxter Superfund Site
Portland, Oregon

2019 Groundwater Elevations
in Monitoring Wells MW-36 and MW-37

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Figure
4-6

Current Top of Wall elevation at 23.35 ft NAVD88

Elevation (feet NAVD88)

Daily Precipitation (inches)

25
20
15
10
5
0

10
8
6
4
2
0

10/1/18
11/1/18
12/1/18
1/1/19
2/1/19
3/1/19
4/1/19
5/1/19
6/1/19
7/1/19
8/1/19
9/1/19
10/1/19

Legend

- MW-44s (Interior)
- MW-44d (Interior)*
- MW-45s (Exterior)
- MW-45d (Exterior)
- River
- Precipitation

Notes:
MW-44 well cluster is located inside the barrier wall and MW-45 well cluster is located outside the barrier wall.

Breaks in transducer data are the result of removal for calibration,removal for well modification, or a transducer was not collecting accurate pressure readings.

Due to barometric pressure transducer failure, barometric pressure data from a weather station at Portland International Airport was used from 06/05/2019 - 09/12/2019. The transducer resolution was reduced to hourly readings to facilitate the use of barometric pressure data from the Portland International Airport weather station.

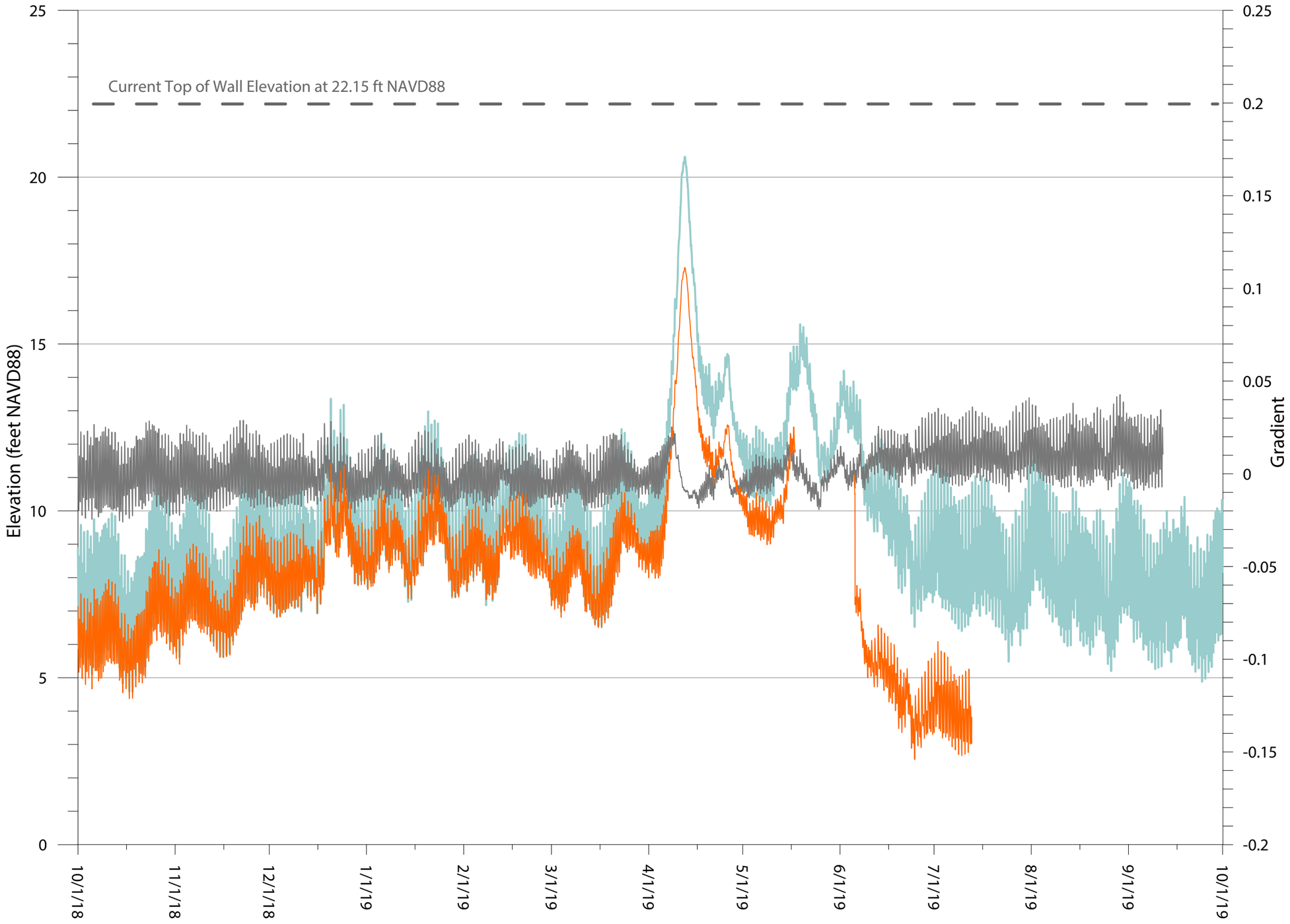
*Incomplete data for MW-44d due to battery failure between 05/17/2019 - 06/05/2019 and 07/13/2019 - 09/12/2019.

McCormick and Baxter Superfund Site
Portland, Oregon

2019 Groundwater Elevations
in Monitoring Wells MW-44 and MW-45

HARTCROWSER
GSI Water Solutions, Inc.

Figure
4-7



Legend

- River
- MW-45s/MW45d gradient (Exterior)
- MW-44s/MW-44d gradient (Interior)

Notes:
MW-44 well cluster is located inside the barrier wall and MW-45 well cluster is located outside the barrier wall.

Incomplete vertical gradient data for MW-44s/MW-44d due to battery failure at MW-44d between 05/17/2019 - 06/05/2019 and 07/13/2019 - 09/12/2019. The transducer resolution was reduced to hourly readings to facilitate the use of barometric pressure data from the Portland International Airport Weather station.

McCormick and Baxter Superfund Site
Portland, Oregon

Groundwater Gradient
in Monitoring Wells MW-44s/d and MW-45s/d

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Figure
4-8

FIGURE 4-9

Measureable LNAPL and DNAPL Distribution Map for June 5, 2019 Sampling Event

McCormick and Baxter Superfund Site
Portland, Oregon

LEGEND

- Subsurface Barrier Wall

Groundwater Monitoring Wells (Thickness, feet, of LNAPL or DNAPL)

- Well with Measureable LNAPL
- Well with Measureable DNAPL
- Well without Measureable LNAPL or DNAPL

NOTES

1. Trace LNAPL was identified in EW-1s, EW-10s, MW-Ds, MW-Gs, and MW-20i
2. Trace DNAPL was identified in EW-18s

Date: March 2, 2020
Data Sources: Aerial photo City of Portland, 2018

0 100 200 300
Feet

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GSI Water Solutions, Inc.

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FIGURE 4-10

Measureable LNAPL and DNAPL Distribution Map for September 12, 2019, Sampling Event

McCormick and Baxter Superfund Site
Portland, Oregon

MW-1r
MW-As
MW-32i
PW-1d
MW-61s
PW-2d
MW-Os
MW-53s
MW-51s
MW-52s
MW-50s
MW-49s
MW-48s
MW-55s
MW-54s
MW-7 WC
EW-1s
(DNAPL, 3.6)
MW-23d
MW-22i
(DNAPL, 6.5)
MW-10r
MW-59s
EW-18s
(DNAPL, 1.7)
EW-8s
(DNAPL, 1.7)
MW-47s
MW-44i
MW-44s
MW-44d
MW-46s
MW-45i
MW-45d
MW-45s
MW-35r
MW-57s
MW-56s
MW-15s
MW-38i
MW-42s
MW-42i
MW-42d
MW-43s
MW-43i
MW-43d
MW-58i
MW-58s
MW-58d
MW-60d
MW-Ds
(DNAPL, 2.9)
EW-15s
(LNAPL, 13.2)
MW-62i
MW-17s
MW-40i
MW-40d
MW-40s
MW-41d
MW-41i
MW-41s
MW-20i
(DNAPL, 4.8)
EW-2s
MW-36s
MW-38d
MW-38s
MW-39s
MW-39i
MW-39d
EW-23s
(LNAPL, 5.1)
MW-36i
MW-GS
(DNAPL, 2.7)
MW-34i
MW-36d
EW-10s
(DNAPL, 1.4)
MW-37d
MW-37i
MW-37s
EW-19s

WILLAMETTE RIVER

LEGEND

- Subsurface Barrier Wall

Groundwater Monitoring Wells (Thickness, feet, of LNAPL or DNAPL)

- Well with Measureable LNAPL
- Well with Measureable DNAPL
- Well without Measureable LNAPL or DNAPL

NOTE

1. Trace LNAPL was identified in MW-36i, MW-38s, MW-38i, MW-38d, MW-39s, MW-39i, MW-39d, MW-40i, MW-40s, MW-42i, MW-42d, MW-43s, MW-43d, MW-45i, MW-46s, MW-47s, MW-48s, and MW-49s

Date: March 2, 2020
Data Sources: Aerial photo City of Portland, 2018

N

0 100 200 300
Feet

HARTCROWSER

GSI Water Solutions, Inc.

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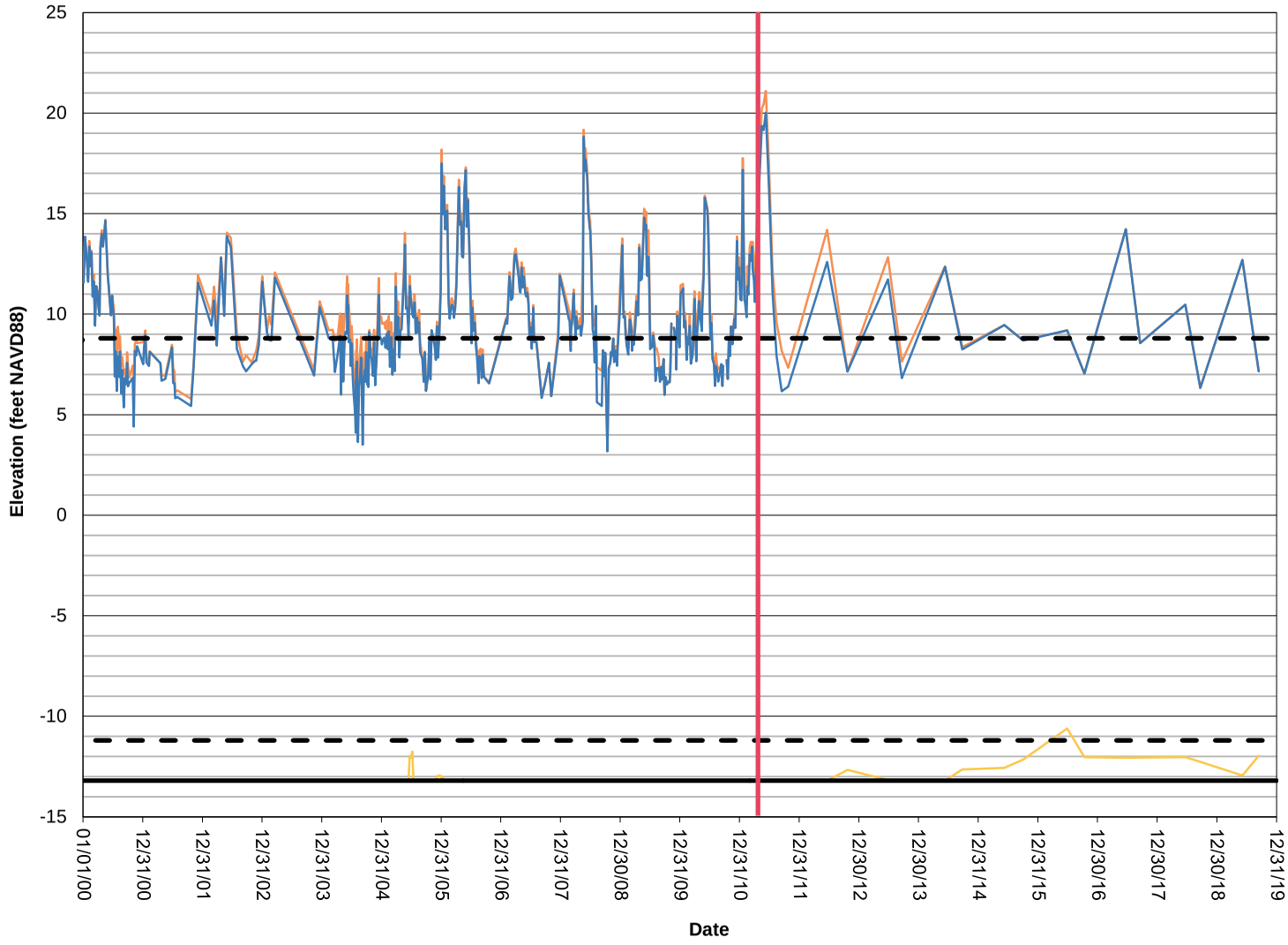
FIGURE 4-11

1999 to 2019 NAPL Thickness Plot for Well EW-10s

McCormick and Baxter Superfund Site
Portland, Oregon



LEGEND

- LNAPL
- Groundwater
- DNAPL
- Well Screen (Top and Bottom)[1]
- Well Depth[2]
- Stopped NAPL Recovery[3]

NOTES

- Barrier Wall Completed 06/30/03
- Grouting Completed 7/2004

1. Top of Well Screen at 8.80 ft NAVD88
   Bottom of Well Screen at -11.20 ft NAVD88
2. Existing Well Depth at -13.20 ft NAVD88
3. Stopped NAPL Recovery 4/21/11

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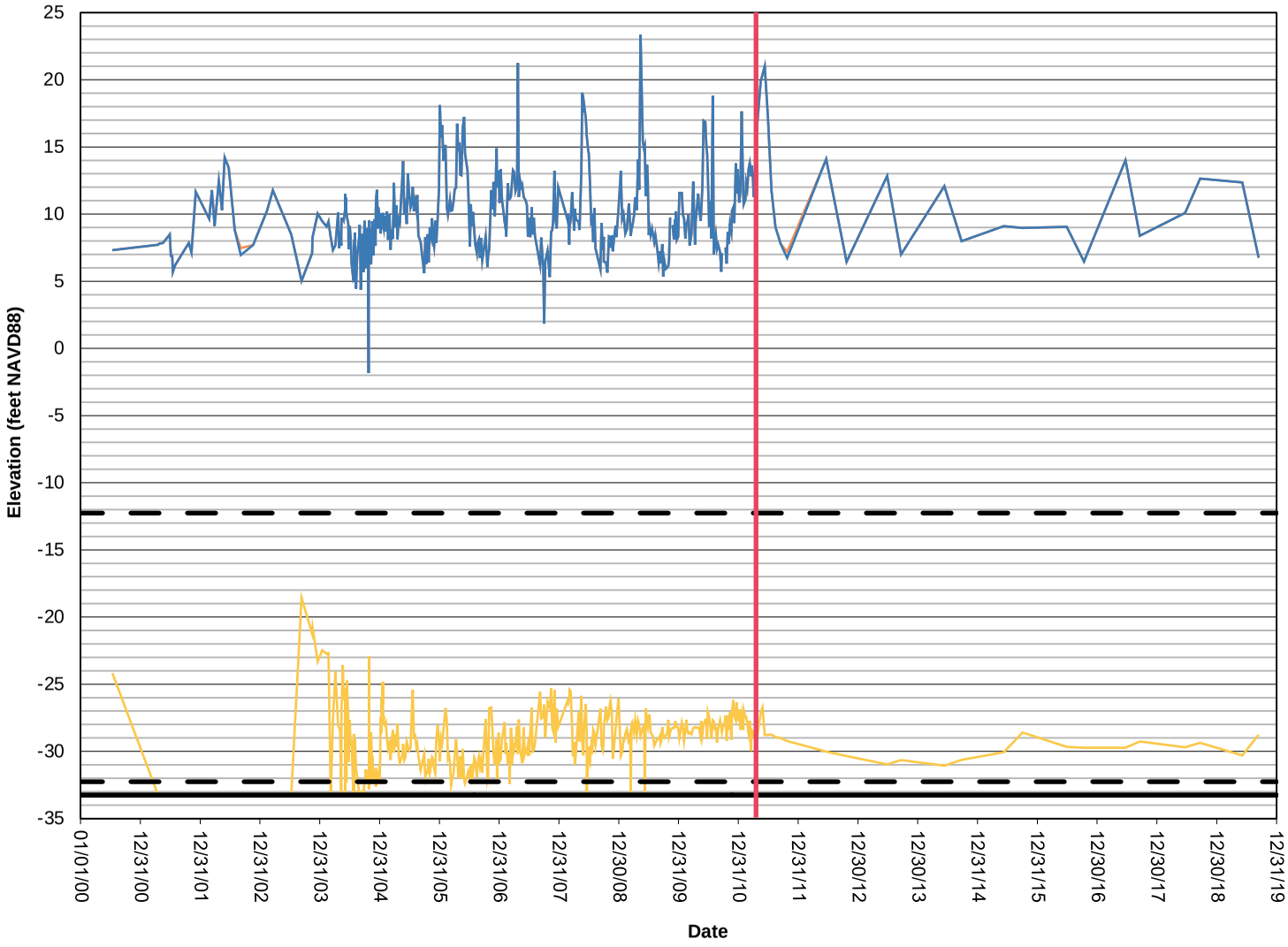
FIGURE 4-12

2001 to 2019 NAPL Thickness Plot for Well MW-20i

McCormick and Baxter Superfund Site
Portland, Oregon



LEGEND

- LNAPL
- Groundwater
- DNAPL
- Well Screen (Top and Bottom)[1]
- Well Depth[2]
- Stopped NAPL Recovery[3]

NOTES

- Barrier Wall Completed 06/30/03
- Grouting Completed 7/2004

1. Top of Well Screen at -12.26 ft NAVD88
   Bottom of Well Screen at -32.26 ft NAVD88
2. Existing Well Depth at -33.26 ft NAVD88
3. Stopped NAPL Recovery 4/21/11

DNAPL recovery was attempted in July 2007 but the extracted liquid appeared to be water with speck sized globules of DNAPL (with a creosote odor), rather than a distinct layer, suggesting that the DNAPL thicknesses measured may not accurately reflect the amount of DNAPL in the well.

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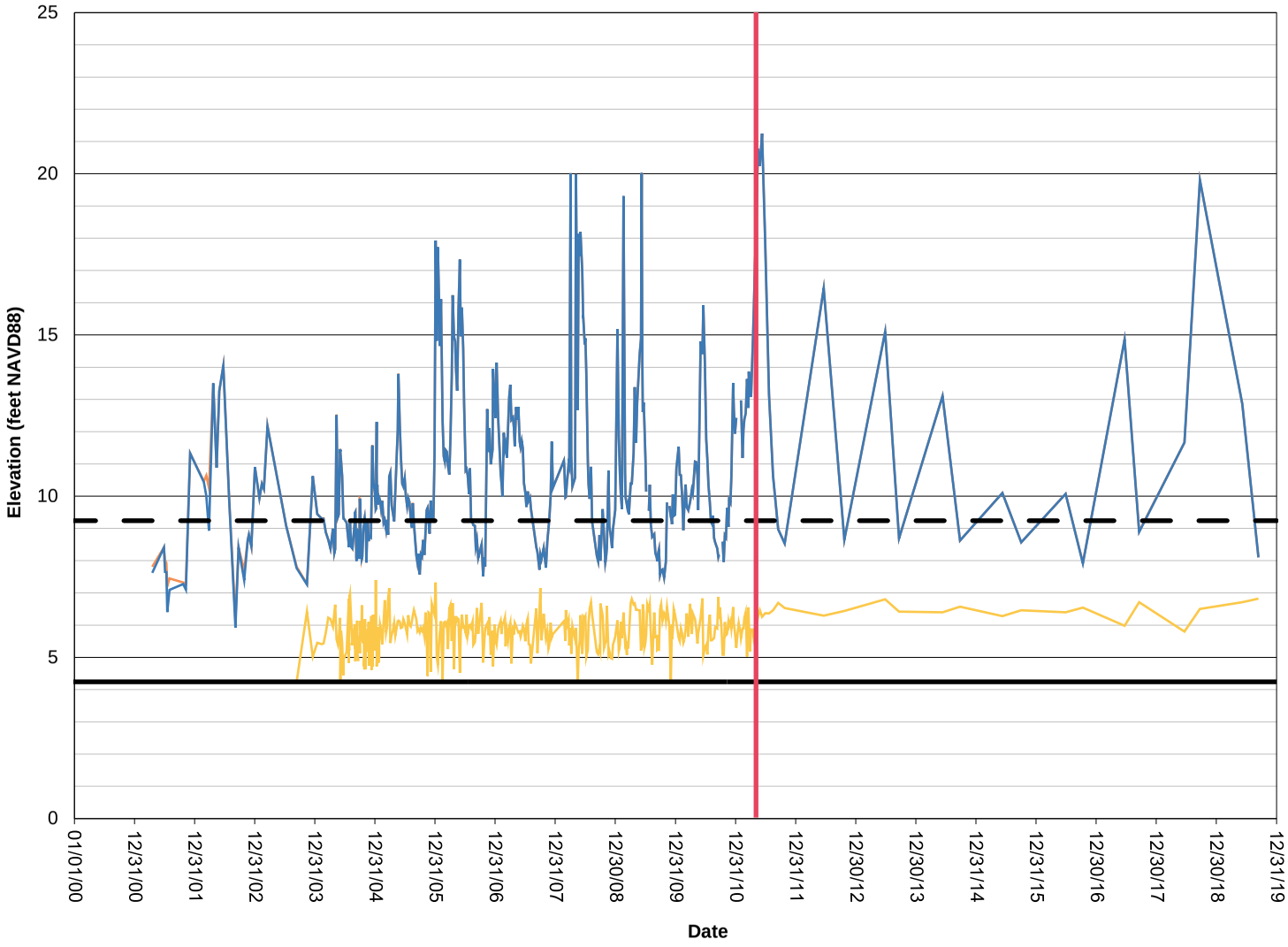
FIGURE 4-13

2001 to 2019 NAPL Thickness Plot for Well MW-Ds

McCormick and Baxter Superfund Site
Portland, Oregon



LEGEND

- LNAPL
- Groundwater
- DNAPL
- Well Screen (Top and Bottom)[1]
- Well Depth[2]
- Stopped NAPL Recovery[3]

NOTES

- Barrier Wall Completed 06/30/03
- Grouting Completed 7/2004

1. Top of Well Screen at 9.24 ft NAVD88
   Bottom of Well Screen at 4.24 ft NAVD88
2. Existing Well Depth at 4.24 ft NAVD88
3. Stopped NAPL Recovery 4/21/11

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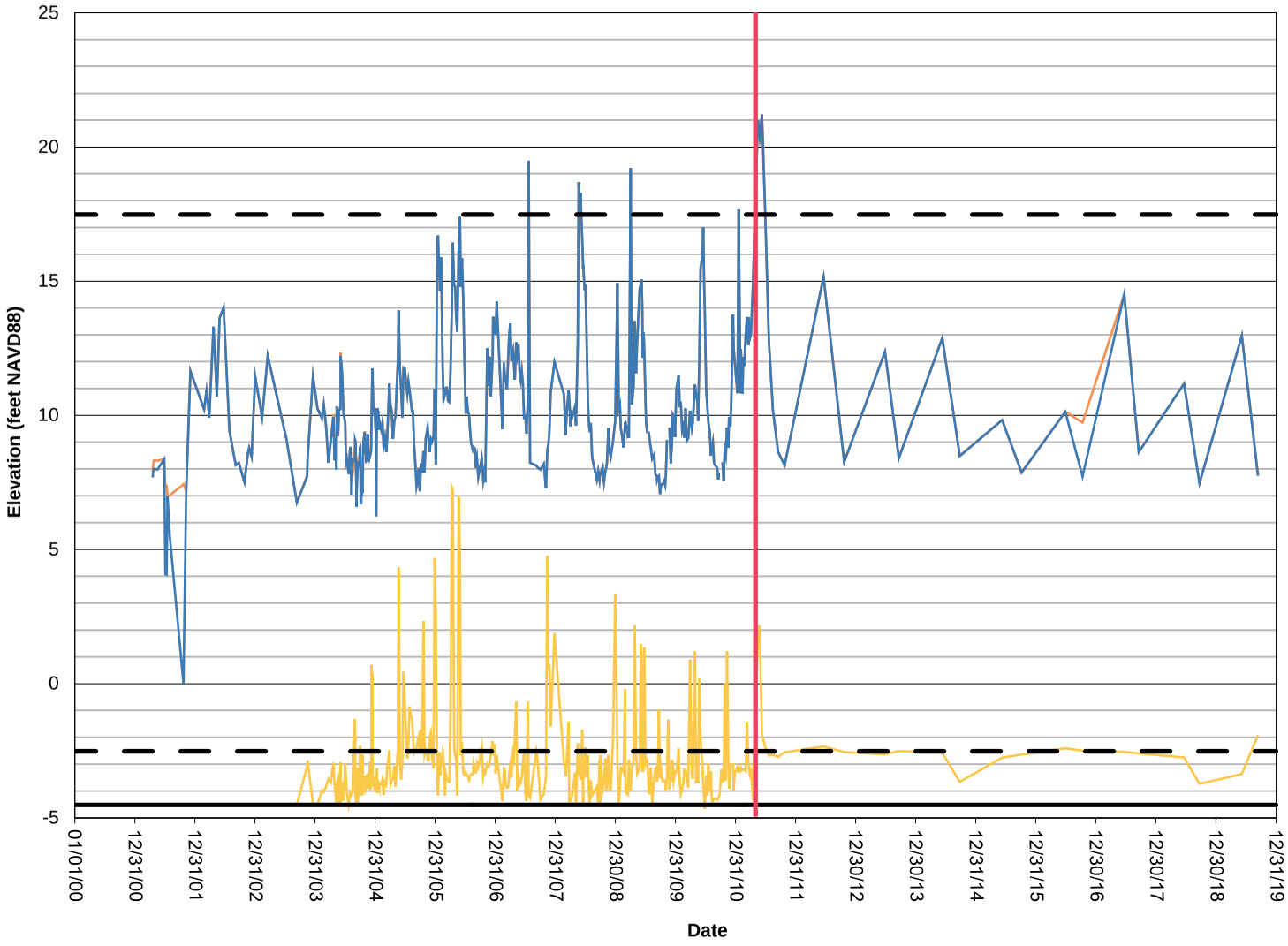
FIGURE 4-14

2001 to 2019 NAPL Thickness Plot for Well MW-Gs

McCormick and Baxter Superfund Site
Portland, Oregon



LEGEND

- LNAPL
- Groundwater
- DNAPL
- Well Screen (Top and Bottom)[1]
- Well Depth[2]
- Stopped NAPL Recovery[3]

NOTES

- Barrier Wall Completed 06/30/03
- Grouting Completed 7/2004

1. Top of Well Screen at 17.48 ft NAVD88
   Bottom of Well Screen at -2.52 ft NAVD88
2. Existing Well Depth at -4.52 ft NAVD88
3. Stopped NAPL Recovery 4/21/11

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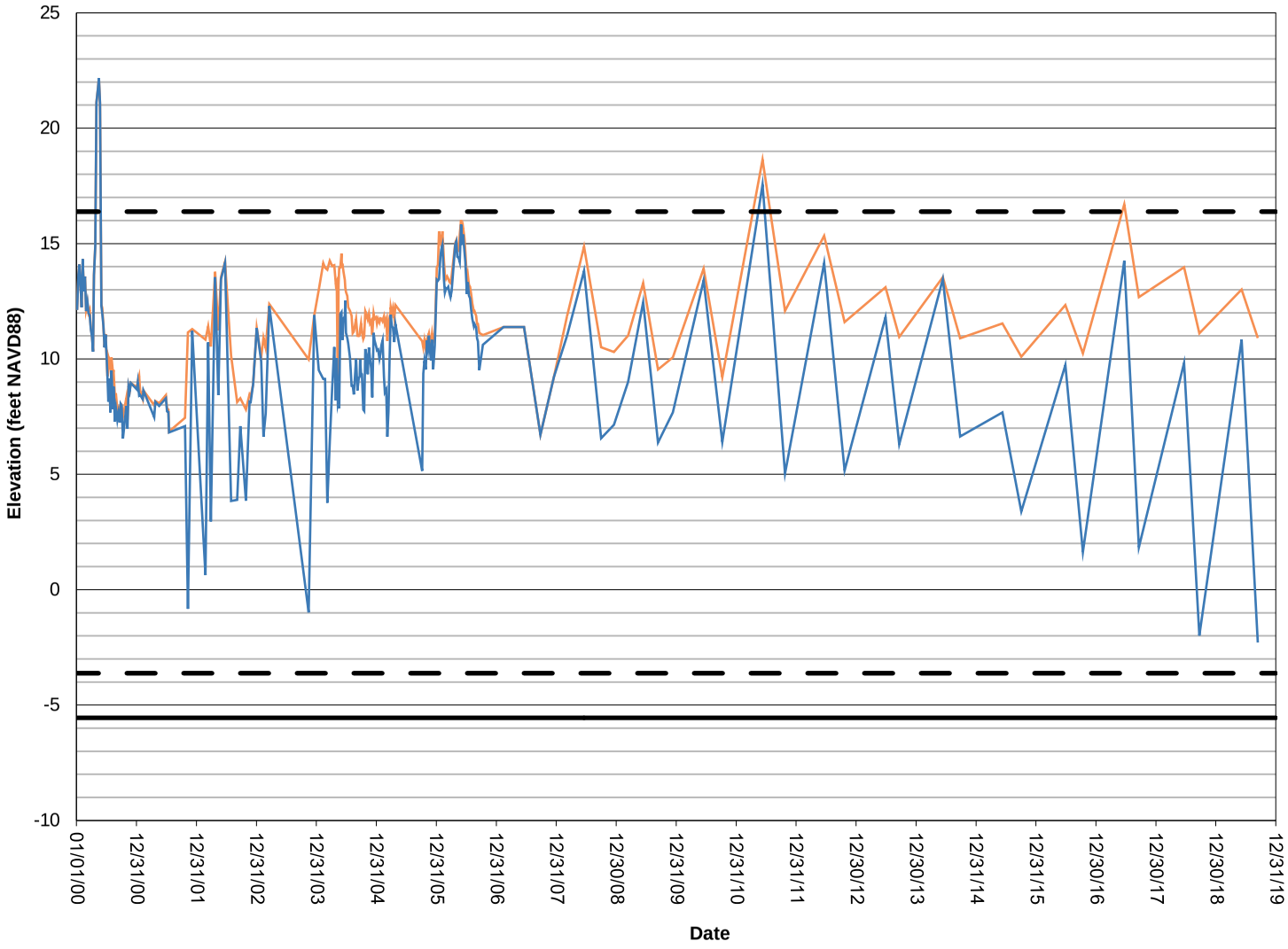
FIGURE 4-15

1999 to 2019 NAPL Thickness Plot for Well EW-15s

McCormick and Baxter Superfund Site
Portland, Oregon



LEGEND

- LNAPL
- Groundwater
- Well Screen (Top and Bottom)[1]
- Well Depth[2]

NOTES

- Barrier Wall Completed 06/30/03
- Grouting Completed 7/2004

1. Top of Well Screen at 16.38 ft NAVD88
   Bottom of Well Screen at -3.62 ft NAVD88
2. Existing Well Depth at -5.55 ft NAVD88

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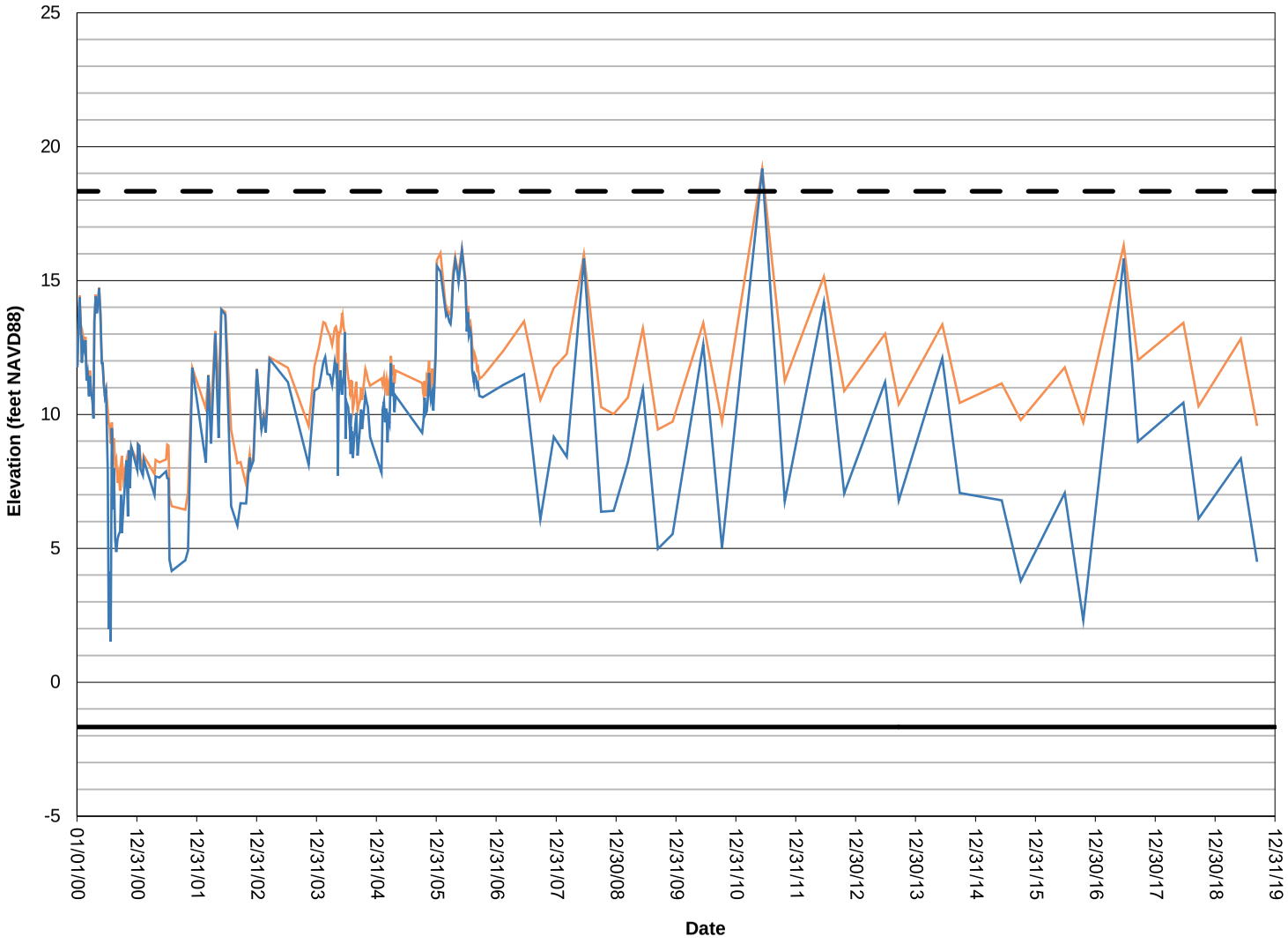
FIGURE 4-16

1999 to 2019 NAPL Thickness Plot for Well EW-23s

McCormick and Baxter Superfund Site
Portland, Oregon



LEGEND

- LNAPL
- Groundwater
- Well Screen (Top and Bottom)[1]
- Well Depth[2]

NOTES

- Barrier Wall Completed 06/30/03
- Grouting Completed 7/2004

1. Top of Well Screen at 18.33 ft NAVD88
   Bottom of Well Screen at -1.67 ft NAVD88
2. Existing Well Depth at -1.67 ft NAVD88

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FIGURE 4-17

2009 to 2019 NAPL Thickness Plot for Well EW-1s

McCormick and Baxter Superfund Site
Portland, Oregon

LEGEND

- LNAPL
- Groundwater
- DNAPL
- Well Screen (Top and Bottom)[1]
- Well Depth[2]
- Stopped NAPL Recovery[3]

NOTES

1. Top of Well Screen at 17.12 ft NAVD88
   Bottom of Well Screen at -7.88 ft NAVD88
2. Existing Well Depth at -7.88 ft NAVD88
3. Stopped NAPL Recovery 4/21/11

Ground subsidence has been observed in the vicinity of EW-1s and the well casing has sunk over time. The screened interval and total well depth have been referenced to the most recent ground survey from September 2009. Given that the elevations are changing with time, the elevations shown are approximate.

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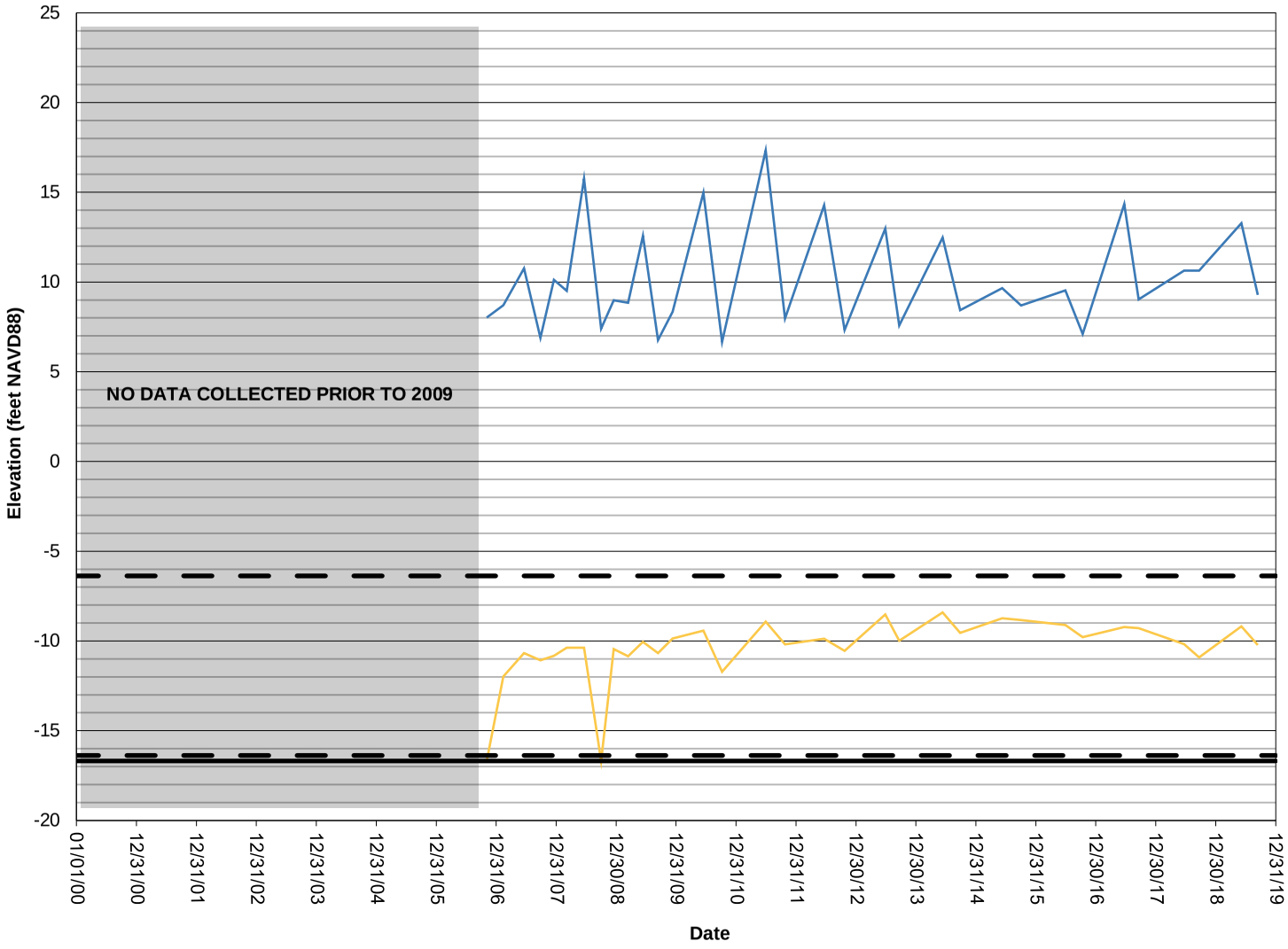
FIGURE 4-18

2006 to 2019 NAPL Thickness Plot for Well ME-22i

McCormick and Baxter Superfund Site
Portland, Oregon



LEGEND

- LNAPL
- Groundwater
- DNAPL
- Well Screen (Top and Bottom)[1]
- Well Depth[2]

NOTES

1. Top of Well Screen at -6.38 ft NAVD88
   Bottom of Well Screen at -16.38 ft NAVD88
2. Existing Well Depth at -16.68 ft NAVD88

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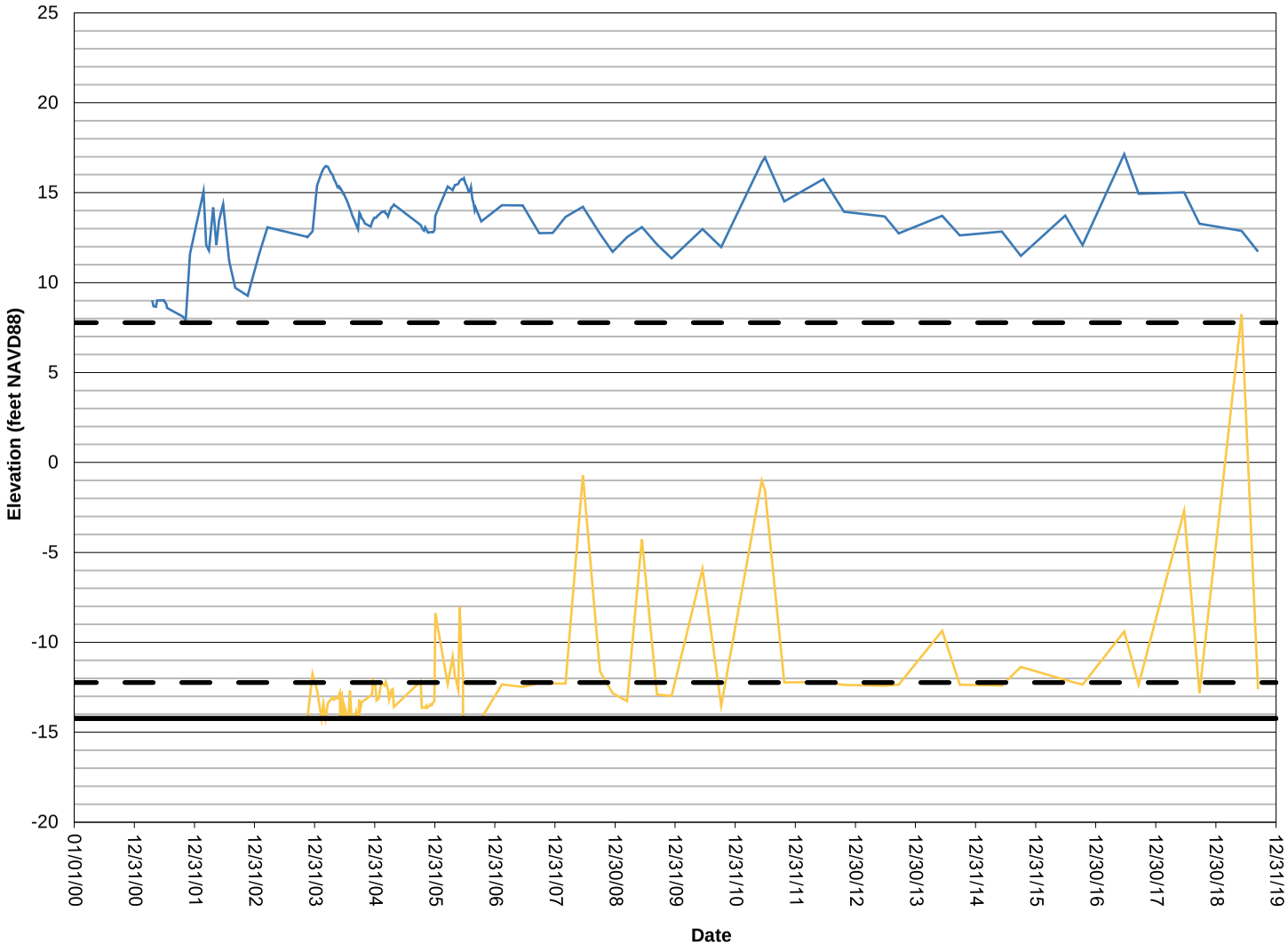
FIGURE 4-19

2001 to 2019 NAPL Thickness Plot for Well EW-8s

McCormick and Baxter Superfund Site
Portland, Oregon



LEGEND

- Groundwater
- DNAPL
- Well Screen (Top and Bottom)[1]
- Well Depth[2]

NOTES

- Barrier Wall Completed 06/30/03
- Grouting Completed 7/2004

1. Top of Well Screen at 7.77 ft NAVD88
   Bottom of Well Screen at -12.23 ft NAVD88
2. Existing Well Depth at -14.23 ft NAVD88

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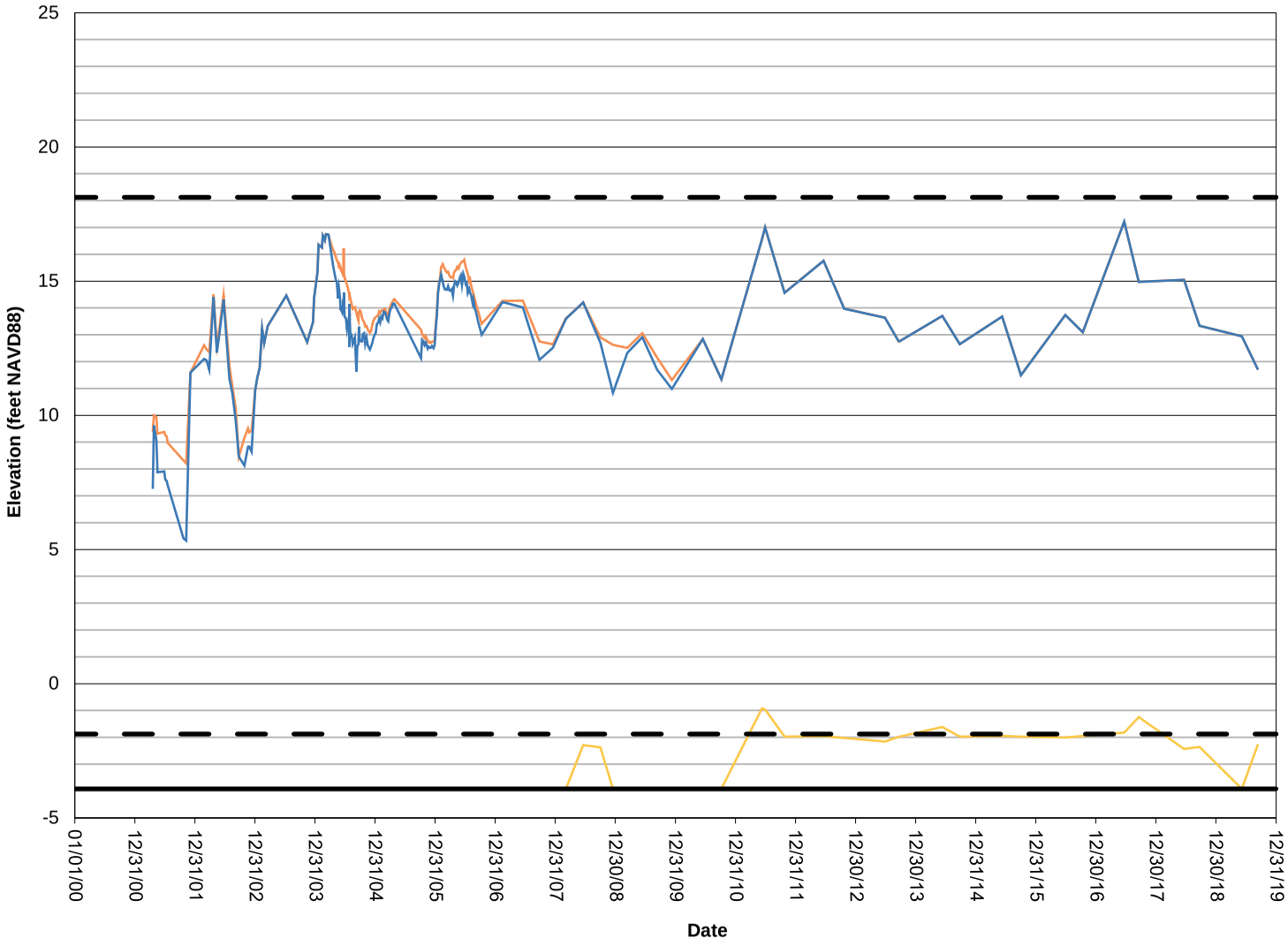
FIGURE 4-20

2001 to 2019 NAPL Thickness Plot for Well EW-18s

McCormick and Baxter Superfund Site
Portland, Oregon



LEGEND

- LNAPL
- Groundwater
- DNAPL
- Well Screen (Top and Bottom)[1]
- Well Depth[2]

NOTES

- Barrier Wall Completed 06/30/03
- Grouting Completed 7/2004

1. Top of Well Screen at 18.12 ft NAVD88
   Bottom of Well Screen at -1.88 ft NAVD88
2. Existing Well Depth at -3.92 ft NAVD88

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ENTRANCE AREA
Fence (Typ.)
Property Line
Gravel Road
Gate
DRAINAGE SWALE
EARTHEN CAP
Union Pacific Railroad
Barrier Wall
Stormwater Retention Pond
Riprap
IMPERMEABLE CAP
Rock Pile
RIPARIAN AREA
Burlington Northern Inc. (Spokane, Portland, and Seattle Railway Co.)
Willamette Cove
Sand Pile
SEDIMENT CAP
Willamette River
1 2 3 4 5 6 7 8 9

1 Photograph Station, Number, and Direction Taken

N

0 200 400
Scale in Feet

McCormick and Baxter Superfund Site
Portland, Oregon

Photograph Station Location Map

03/20

HARTCROWSER GSI Water Solutions, Inc.

Figure
5-1

File: \\pdxsrv\data\Notebooks\150002005_DEQ_McCormick_and_Baxter_Soil_and_Sed_O_and_M\CAD\150002005_(Site Plan).dwg Layout:SitePlan Date: 03-21-2020 Author: melissaschweitzer

APPENDIX A
Photograph Log – Site Activities and Observations

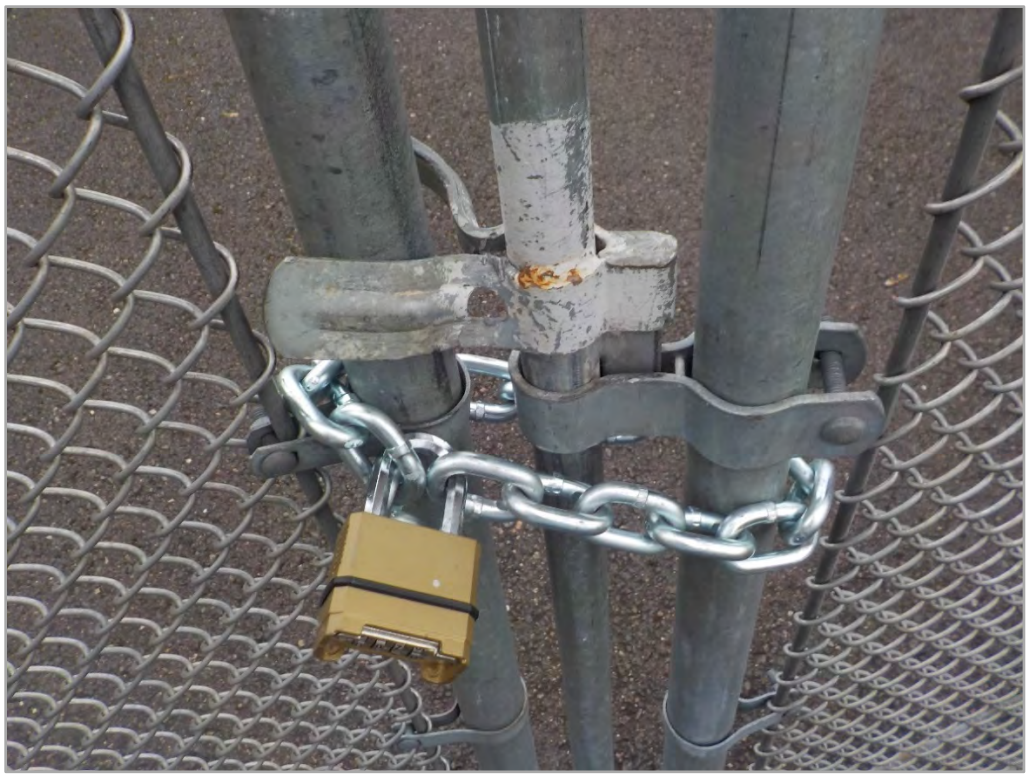
Photograph A1: View facing north of Willamette Cove shoreline and derelict boats anchored within the cove (February 2019).

Photograph A2: One of several dumpsites for trash in the riparian area along the Willamette River (February 2019).

Photograph A3: Driftwood tree trunk burned in July 2018 riparian fire burn area (February 2019).

Photograph A4: Shoreline conditions along the Willamette River (February 2019).

Photograph A5: View facing north of September 2018 grass fire burn area (February 2019).



Photograph A6: Replacement lock with hardened steel shackle on gate to paved storage area after prior lock was cut off (March 2019).

Photograph A7: Gas vent GV-4 with missing vault (March 2019).

Photograph A8: Gas vent GV-2 with intact vault (March 2019).

Photograph A9: Burned holes in TRM following July 2018 riparian area fire. Holes appear stable and are not increasing in size (April 2019).

Photograph A10: Impermeable Cap vegetative cover conditions in vicinity of EW-1s. View facing north (April 2019).

Photograph A11: Filled animal burrow beneath access gate in southwest corner of the site (May 2019).

Photograph A12: Completed installation of replacement vault box for gas vent GV-4 (May 2019).

Photograph A13: New growth on trees within the July 2018 riparian fire burn area. Regrowth of grass groundcover is complete (July 2019).

Photograph A14: View facing northwest of the shoreline along the Willamette River (July 2019). Cover gravel washed from the upper slope of the ACB surface is visible along the waterline.

Photograph A15: Upland Cap area cover vegetation conditions (July 2019).

Photograph A16: MW-59s well casing and cap sticking above rim of well box prior to trimming (August 2019).

Photograph A17: Properly seated well box lid for MW-59s following trimming of the well casing by 2.125 inches (August 2019).

Photograph A18: Video inspection of the storm sewer using a robotic crawler. Crawler is being lowered into manhole SDMH-C (October 2019).

Photograph A19: Area of sand erosion under TRM along walking path near MW-37 well cluster (October 2019).

Photograph A20: Water drainage of less than 1 gallon per minute from the storm sewer outfall (October 2019).

Photograph A21: Willamette River Shoreline during low tide in the vicinity of MW-39 well cluster facing southeast (October 2019). Driftwood and several items of trash visible, including a heavy equipment tire. Cover gravel washed down from the upper slope of the ACB is visible lower on the ACB slope.

APPENDIX B
Site Activity Documentation

McCormick & Baxter Operational & Functional Determination Period Status Meeting Report

Thursday 02/07/2019
1:00 P.M.
6900 N. Edgewater Street
Portland, OR 97203

Meeting called by:	Oregon Department of Environmental Quality (DEQ)	Type of Meeting:	Quarterly Progress Meeting
Facilitator:	Sarah Miller	Note Taker:	Kaylan Smyth
Attendees:	Sarah Miller	Project Officer	DEQ
	Kaylan Smyth	Site Manager	Hart Crowser
	Erin Carroll Hughes	Hydrogeologist	GSI
	Tess Lydick	Staff Geologist	Hart Crowser

Site Status Meeting Notes

Site Walk and Inspection

The attendees completed a thorough inspection of the entire site on February 7, 2019. The next inspection is scheduled for April/May 2019. Site photos and descriptive map are included at the end of this summary.

Site Walk – Shoreline

The following items were inspected along the shoreline:

- Gravel overlay on ACB.
- Buoy locations.
- Stormwater discharge.
- Willamette River and Willamette Cove shoreline conditions.
- Ebullition from sediment cap.
- Shoreline vegetation repairs.
- Fire damage along Willamette River shoreline in the riparian area.

The September 2017 shoreline ACB repairs continue to appear to be in good condition and will be monitored throughout the year. Wildlife (geese, seagulls) were observed along the Willamette River shoreline during site walk (Photo 1).

The Willamette River tides at the time of inspection (between 1:00 PM and 4:00 PM) were at 3.50 and 3.18 feet COP (or 8.50 and 8.28 NAVD88). Daily low tides were at 3:45 AM and 3:30 PM with a tide of approximately 2.85 feet COP (or 7.95 NAVD88) and 3.02 COP (or 8.12 NAVD88), respectively. The five buoys were visible and appeared to be in good condition and functional.

There was discharge from the stormwater discharge outfall (Photo 3) at approximately 5 gallons per minute. The outfall is in good condition. Roughly 50% of the rock armoring below the outfall was washed away from the drainage channel, but the ACB and overlying filter fabric remains in place and erosion of the cap doesn't appear to be a concern. No repairs are planned.

Four derelict boat were anchored within Willamette Cove during the site walk. The boats did not appear to be anchored on top of the ACB in Willamette Cove.

No ebullition was observed in the area above the granular organoclay along the Willamette River shoreline or in Willamette Cove.

A brush fire in August 2018 burned approximately one acre in the riparian area. Larger/mature trees may have survived as their bark did not appear to be charred; however smaller trees, brush and grass were burned. Vegetation appears to be thriving with evident signs of grass spouting in the undergrowth and

new buds appearing on existing brush (Photo 3). The fire appeared to burn several holes (~3 inch diameter) in the TRM in the riparian area. The TRM appeared to be in good condition, further monitoring will be conducted in future inspections.

Scattered debris was observed along the shoreline and multiple abandoned dump sites were observed along the riparian area (see Photo 4). Metro and DEQ discussed plans for removing debris from the dump sites. No active houseless camps were observed.

Site Walk – Upland

The following items were inspected during the upland site walk and inspection:

- Site perimeter and fence, and drainage basin.
- Subsurface drainage (manholes).
- Soil cap (burrows, erosion, etc.).
- EW-1s and MW-23d area of subsidence.
- Fire damage at the northeast end of the site.
- Verify the water supply sources at the site and identify backflow values

The site perimeter fence was intact. The lock at the north entrance gate (Edgewater Rd) had been cut. A fire department lock had been put on the south entrance gate. A new lock was installed on the north entrance gate. Animal burrows were frequently observed around the site, but are generally less than 6 inches deep and don't require repairs. A few larger burrows (~0.5 foot deep) were observed along the perimeter gravel roads.

The manhole SDMH-B was not inspected during this meeting. This outfall, coupled with the discharge from the stormwater outfall will be monitored in the future to determine if the stormwater drainage system within the RCRA-style soil cap is functioning as designed.

The two coyotes were observed roaming on the soil cap during the site inspection.

The distance between the inner and outer casing of MW-23d was 2.75 inches, which is the same as recent measurements.

The brush fire in September 2018 burned approximately one acre on the northeast end of the site near the railroad. The brush had been burned, but it appears there was no damage to the cap. Vegetation is thriving with evident signs of spouting grass.

A few plastic drums and a stack of plastic buckets are still present in the storage area. There was flooding at the storage area due to pump being unplugged (Photo 5). The pump started up again shortly after being plugged in. The pump will be monitored in future inspections.

Action Items:	Person Responsible	Deadline
■ Continue to Monitor MW-23d inner/outer casing relationship for movement.	Kaylan Smyth	Quarterly
■ Monitor burned holes (approximately 3-inch diameter) in the TRM in brush fire area.	Kaylan Smyth	Quarterly
■ Quarterly Site Inspections	Kaylan Smyth	Quarterly
■ Site Maintenance – Replace locks with hardened steel combo padlocks, fill-in burrows along the fence line and shop maintenance (e.g. mouse traps, check equipment)	Kaylan Smyth Tess Lydick	February/March 2019
■ Draft Annual Report	Kaylan Smyth Erin Carroll Hughes	February 2019
■ Final Annual Report	Kaylan Smyth Erin Carroll Hughes	March 2019
■ Vegetation Inspection	Tim Walters	June 2019
■ Low-tide monitoring and transducer download (Task Order 72-18-6)	Kaylan Smyth Tess Lydick Dan Knapp	June 2019
■ Riparian area watering events	Tess Lydick Dan Knapp	August/September 2019
■ Plan activities for the Five-Year Review Report	Erin Carroll Hughes Sarah Miller Kaylan Smyth	May through September 2019

Site Activities / Miscellaneous Field Activities

- DEQ is coordinating with Metro to cleanup the dumpsites in the riparian area along the Willamette River shoreline before the end of February 2019.
- DEQ is in discussions with the City of Portland's contractor to use the site as a staging area for construction equipment.

Deliverables

- A Budget and Assumption Proposal was submitted on February 5, 2019 to continue Groundwater Operational and Maintenance activities. It is currently being reviewed.

Budget Status: Currently at/or below the anticipated budget.

Meeting Status:

Date / Time	TBD – April/May 2019
Location	McCormick & Baxter Facility

Photos:

Photo 1 –View of the bird wildlife along the Willamette River Shoreline.

Photo 2 –View of stormwater discharge outfall at approximately 5 gallons per minute.

Photo 3 –View of returning vegetation in the riparian area after the fire in August 2018.

Photo 4 –View of debris from dump site in the riparian area.

Photo 5 –View of the ponding at the site outdoor storage area. Pump was reset.

LEGEND

- Groundwater Monitoring Wells
- Groundwater Monitoring Wells with Transducers
- Subsurface Barrier Wall

Notes from 02/07/2019
HC Rep: KS + TL
Wx: Clear, Cool (40 degrees F)

Location of dumb site

NOTE:
Aerial photo taken on September 22, 2006.

0 200 400
Scale in feet

McCormick and Baxter Superfund Site
Portland, Oregon

Groundwater Monitoring Well Location Map

12/15

HARTCROWSER GSI Water Solutions, Inc.

Figure
4-1

Document Path: P:\Portland\205 - OR DEQ\003 - 003 McCormick and Baxter\Project GIS\Project mxds\2015 Annual Report\Figure4-1 Monitoring Well Location Map.mxd

McCormick & Baxter Operational & Functional Determination Period Status Meeting Report

Thursday 04/03/2019
9:00 P.M.
6900 N. Edgewater Street
Portland, OR 97203

Meeting called by:	Oregon Department of Environmental Quality (DEQ)	Type of Meeting:	Quarterly Progress Meeting
Facilitator:	Sarah Miller	Note Taker:	Kaylan Smyth/Tess Lydick

Attendees:	Sarah Miller	Project Officer	DEQ
	Rick Ernst	Program Manager	Hart Crowser
	Kaylan Smyth	Site Manager	Hart Crowser
	Tess Lydick	Staff Geologist	Hart Crowser
	Erin Carroll Hughes	Hydrogeologist	GSI
	Andrew Davidson	Engineer	GSI

Site Status Meeting Notes

Site Walk and Inspection

The attendees completed a thorough inspection of the entire site on April 3, 2019. The next inspection is scheduled for June/July 2019. Andrew Davidson will be taking over Erin Carroll Hughes responsibilities starting mid-April, 2019. Site photos are included at the end of this summary.

Site Walk – Shoreline

The following items were inspected along the shoreline:

- Willamette River and Willamette Cove shoreline conditions.
- Gravel overlay on ACB.
- Buoy locations.
- Stormwater discharge.
- Derelict boats
- Ebullition from sediment cap.
- Shoreline vegetation
- Fire damage along Willamette River shoreline in the riparian area.
- Debris and dumpsites

The September 2017 shoreline ACB repairs continue to appear to be in good condition and will be monitored throughout the year. Erosion is present underneath the TRM in the riparian area and DEQ requested for voids to be filled in with soil (Photo 1). Multiple one to three inch diameter holes (Photo 2) and approximately six-inch patches (Photo 3) in the TRM are visible in the lower end of the riparian area as a result of last year's riparian fire. Monitoring will be performed to see if vegetation fills in the damaged areas.

The Willamette River tides at the time of inspection (between 9:00 AM and 12:00 PM) were at 4.79 and 3.90 feet COP (or 9.79 and 8.90 NAVD88). Daily high and low tides were at 5:30 AM and 1:30 PM with a tide of approximately 5.90 feet COP (or 10.90 NAVD88) and 3.64 COP (or 8.64 NAVD88), respectively. The five buoys were visible and appeared to be in good condition and functional.

There was discharge from the stormwater discharge outfall (Photo 4) at approximately 5 gallons per minute. The outfall is in good condition. Roughly 50% of the rock armoring below the outfall was washed away from the drainage channel, but the ACB and overlying filter fabric remains in place and erosion of the cap doesn't appear to be a concern. No repairs are planned.

Four derelict boat were anchored within Willamette Cove during the site walk. The boats did not appear to be anchored on top of the ACB in Willamette Cove.

Sporadic ebullition was observed during the site walk in the area above the granular organoclay along the in Willamette Cove. No Ebullition was observed along the Willamette River shoreline.

A brush fire in August 2018 burned approximately one acre in the riparian area. Larger/mature trees may have survived as their bark did not appear to be charred; however smaller trees, brush and grass were burned. Vegetation appears to be thriving with evident signs of grass spouting in the undergrowth and new buds appearing on existing brush (Photo 5).

A cleanup effort was done by Metro and DEQ in removing dump sites. Scattered debris was observed along the shoreline along the riparian area. No active houseless camps or dump sites were observed.

Site Walk – Upland

The following items were inspected during the upland site walk and inspection:

- Site perimeter and fence, and drainage basin.
- Subsurface drainage (manholes) – Manhole SDMH-B
- Soil cap (burrows, erosion, etc.).
- EW-1s and MW-23d area of subsidence.
- Fire damage at the northeast end of the site.
- Inspect MW-59s (maintenance)
- Inspect Gas Vents (maintenance)

The site perimeter fence was intact. A new lock was installed on the east entrance gate. Animal burrows were frequently observed around the site, but are generally less than 6 inches deep and don't require repairs. A few larger burrows (~0.5 foot deep) were observed along the perimeter gravel roads.

The manhole SDMH-B was not inspected during this meeting. This outfall, coupled with the discharge from the stormwater outfall will be monitored in the future to determine if the stormwater drainage system within the RCRA-style soil cap is functioning as designed.

The distance between the inner and outer casing of MW-23d was 2.75 inches, which is the same as recent measurements.

The brush fire in September 2018 burned approximately one acre on the northeast end of the site near the railroad. The brush had been burned, but it appears there was no damage to the cap. Vegetation is thriving with evident signs of spouting grass.

The MW-59s well casing protrudes too high for the monument lid to be installed (Photo 6). It was agreed between DEQ and Hart Crowser that the well casing should be cut down 3-inches. A survey will be completed before and after cutting the well casing.

Gas vents, G-1 and G-4, currently do not have plastic protective covers. Protective covers will be installed during the next site maintenance visit.

A few plastic drums and a stack of plastic buckets are still present in the storage area.

Action Items:	Person Responsible	Deadline
■ Continue to Monitor MW-23d inner/outer casing relationship for movement.	Kaylan Smyth	Quarterly
■ Monitor burned holes (approximately 1 to 3-inch diameter) and 6 inch patches in the TRM in brush fire area.	Kaylan Smyth	Quarterly
■ Quarterly Site Inspections	Kaylan Smyth	Quarterly
■ Vegetation Inspection	Tim Walters	June 2019
■ Low-tide monitoring and transducer download (Task Order 72-18-6)	Kaylan Smyth Tess Lydick Dan Knapp	June 2019
■ Site Maintenance – Cut MW-59s well casing, install G-1 and G-2 gas vent covers, fill-in burrows along the fence line and shop maintenance	Kaylan Smyth Tess Lydick	June 2019
■ Riparian area watering events	Tess Lydick Dan Knapp	August/September 2019
■ Plan activities for the Five-Year Review Report	Andrew Davidson Sarah Miller Kaylan Smyth	May through September 2019

Site Activities / Miscellaneous Field Activities

- DEQ is in discussions with the City of Portland's contractor to use the site as a staging area for construction equipment.

Deliverables

- A Budget and Assumption Proposal was submitted on February 5, 2019 and signed on February 15, 2019.

Budget Status: Currently at/or below the anticipated budget.

Meeting Status:

Date / Time	TBD – June/July 2019
Location	McCormick & Baxter Facility

Photos:

Photo 1 –View of the erosion under the TRM along the riparian area.

Photo 2 –View of one to three-inch diameter holes in the TRM caused by the 2018 fire in the riparian area.

Photo 3 –View of six-inch diameter patches in the TRM as a result of the 2018 fire in the riparian area.

Photo 4 –View of stormwater discharge outfall at approximately 5 gallons per minute.

Photo 5 –View of returning vegetation in the riparian area after the fire in August 2018.

Photo 6 –View of the inner casing protruding past the monument in MW-59s.

McCormick & Baxter Operational & Functional Determination Period Status Meeting Summary

Thursday 7/18/2019
9:00 A.M.
6900 N. Edgewater Street
Portland, OR 97203

Meeting called by:	Oregon Department of Environmental Quality (DEQ)	Type of Meeting:	Quarterly Progress Meeting
Facilitator:	Sarah Miller	Note Taker:	Kevin Woodhouse
Attendees:	Sarah Miller	Project Officer	DEQ
	Kevin Woodhouse	Site Manager	Hart Crowser
	Tim Walters	Biologist	Hart Crowser
	Andrew Davidson	Engineer	GSI

Site Status Meeting Notes

Site Walk and Inspection

Attendees Sarah Miller, Kevin Woodhouse, and Andrew Davidson performed a thorough inspection of the site from 09:45 until approximately 11:00 on July 18, 2019. Tim Walters was onsite performing a follow up inspection of the herbicide application to evaluate treatment efficacy but did not participate in the full site inspection. Trang Lam from the University of Portland planned to attend the site inspection, however was ultimately unable to attend.

Shoreline Inspection

The following items were inspected near the shoreline:

- Willamette River and Willamette Cove shoreline conditions.
- Buoy locations.
- Derelict boats
- Debris and dumpsites
- Gravel overlay on ACB.
- Stormwater discharge.
- Ebullition from sediment cap.
- Shoreline vegetation
- Fire damage along Willamette River shoreline in the riparian area.

The Willamette River tides at the time of inspection (between 09:45 and 11:00) were at 3.65 COP (8.65 NAVD88) and 3.37 feet COP (8.47 NAVD88). Daily high and low tides were at 06:00 and 15:00 with a tide of approximately 5.02 feet COP (10.12 NAVD88) and 1.98 COP (7.08 NAVD88), respectively. The five buoys were visible and appeared to be in good condition and functional.

Four derelict boats anchored in Willamette Cove during previous site inspections were observed to still be present. None appeared to be anchored on the ACB shoreline of Willamette cove. A single tent was observed just north of the pathway leading down to Willamette Cove parallel to the Burlington Northern rail line (Photo 1). The area around the tent will continue to be monitored for signs of further encampment and potential trash/ debris dumping. No other trash, dump sites, or homeless encampments were observed. As the inspection progressed along the riparian area shoreline, a fishing boat with two occupants were observed fishing just outside the buoys in the Willamette River (Photo 2).

The September 2017 shoreline ACB repairs continue to appear to be in good condition and will continue to be monitored throughout the year. Patches of river rock were present along the lower edge of the shoreline along the riparian area. The presence gravel was very sparse to not present higher up on the shoreline near the base of the TRM (Photo 3). Some small erosional depressions (Photo 4) were observed at seams along the TRM. The depressions will be monitored and filled in with soil if observed

to increase in size. Some areas along the toe of the TRM have been shredded by wood trunks or debris that have washed up on the shoreline. Damage occurred on portions of the TRM covering the ACB and did not affect the coverage over soil portions. Damage will be monitored and pieces will be cut off as necessary to prevent it from ripping off later and mobilizing as trash in the river.

No stormwater discharge was observed from the outfall during the site inspection. The outfall is in good condition. Vegetation is growing between the rock armoring near the outfall and may need to be pruned in the future. No change to the outfall armoring since the last inspection were observed. No repairs are planned and the armoring will be monitored during the rainy season for signs of additional scouring or erosion.

No ebullition was observed from the organoclay layers in Willamette Cove or the Willamette River.

A brush fire in August 2018 burned approximately one acre in the riparian area. Groundcover in the area has recovered with grasses and some noxious weeds present. Larger trees and shrubs show signs of recovery with new leaf development. Most evergreen species of trees have yet to show signs of new growth from charred trunks (Photo 5).

Vegetation in the riparian area did not show signs of drought stress to necessitate the need to schedule a watering event. The vegetation will continue to be monitored and watering events will be scheduled as needed.

Site Walk Upland

The following items were inspected during the upland site walk and inspection:

- Site perimeter and fence, and drainage basin.
- Subsurface drainage (manholes) – Manhole SDMH-B
- Soil cap (burrows, erosion, etc.).
- EW-1s and MW-23d area of subsidence.
- Fire damage at the northeast end of the site.

The site perimeter fence was intact. No cut locks were found and no animal burrows greater than 6 inches deep requiring filling were observed.

The manhole SDMH-B was not inspected during this meeting. The stormwater drainage system will be video scoped to visually inspect integrity of the system during future site maintenance activities to ensure the system is functioning as designed.

The distance between the inner and outer casing of MW-23d was 2.75 inches, which is the same as recent measurements.

The brush fire in September 2018 burned approximately one acre on the northeast end of the site near the railroad. Grass vegetation has recovered in the area and no visible burn area remains.

The MW-59s well casing protrudes too high for the monument lid to be installed. It was agreed between DEQ and Hart Crowser that the well casing should be cut down 3-inches. Cutting of the well casing will be performed during the land survey so the well can be measured pre and post well casing modification.

A few plastic drums and a stack of plastic buckets are still present in the storage area.

Action Items and Schedule:	Person Responsible	Deadline
■ Site Maintenance – Replace locks if any found to be cut, fill-in burrows along the fence line, perform shop maintenance (e.g. mouse traps, check equipment)	Kevin Woodhouse	Quarterly
■ Continue to Monitor MW-23d inner/outer casing relationship for movement.	Kevin Woodhouse	Quarterly
■ Monitor burned holes (approximately 3-inch diameter) in the TRM in brush fire area.	Kevin Woodhouse Dan Knapp Tess Lydick	Quarterly
■ Quarterly Site Inspections	Kevin Woodhouse	Quarterly
■ Plan activities for the Five-Year Review Report	Andrew Davidson Kevin Woodhouse	April through September 2019
■ Topographic and site features survey	Kevin Woodhouse	July/ August 2019
■ Well casing modification on MW-59s	Kevin Woodhouse	July/ August 2019
■ Riparian area watering events	Kevin Woodhouse	August/ September 2019
■ Low-tide monitoring and transducer download (Task Order 72-18-6)	Kevin Woodhouse Dan Knapp Tess Lydick	September 2019

Site Activities / Miscellaneous Field Activities

- Clean storage building and perform maintenance as needed.
- Inspect herbicide application effectiveness on noxious weeds.

Deliverables

- No deliverables were submitted subsequent to the last site visit.

Budget Status: Hart Crowser will prepare a BAP to cover herbicide application, surveying work, and video scoping of the drainage system. Task 2 is currently overbudget as it includes costs for herbicide application. The overbudget costs will be covered by the forthcoming BAP.

Meeting Status:

Date / Time	TBD – October 2019
Location	McCormick & Baxter Facility

Photos:

Photo 1 –View of encampment along Willamette Cove shoreline

Photo 2 –View of fisherman fishing outside buoy boundary on Willamette River

Photo 3 –View of riparian area shoreline with gravel and ACB coverage.

Photo 4 –View of small erosional pocket between seam of TRM.

Photo 5 –View of new foliage on tree trunks charred by the August 2018 brush fire.

McCormick & Baxter Operational & Functional Determination Period Status Meeting Summary

Wednesday 10/16/2019
9:00 A.M.
6900 N. Edgewater Street
Portland, OR 97203

Meeting called by:	Oregon Department of Environmental Quality (DEQ)	Type of Meeting:	Quarterly Progress Meeting
Facilitator:	Sarah Miller	Note Taker:	Kevin Woodhouse
Attendees:	Sarah Miller Kevin Woodhouse Andrew Davidson	Project Officer Site Manager Environmental Engineer	DEQ Hart Crowser GSI

Meeting Summary

Site Walk and Inspection

Attendees Sarah Miller, Kevin Woodhouse, and Andrew Davidson performed an inspection of the site from 0945 to approximately 1130 on October 16, 2019. Weather conditions during the inspection ranged from a light rain at the beginning of the inspection to heavy rain at the end.

Shoreline Inspection

The following items were inspected along the shoreline:
Shoreline:

- Willamette River and Willamette Cove shoreline conditions.
- Gravel overlay on ACB.
- Buoy locations.
- Stormwater discharge.
- Derelict boats
- Ebullition from sediment cap.
- Shoreline vegetation
- Fire damage along Willamette River shoreline in the riparian area.
- Debris and dumpsites

The Willamette River tides at the time of inspection (between 09:45 and 11:30) were at 2.81 COP (8.23 NAVD88) and 2.27 feet COP (7.37 NAVD88). Daily low and high tides were at 04:05 and 07:55 with a tide of approximately 0.95 feet COP (6.05 NAVD88) and 4.13 COP (9.23 NAVD88), respectively. The five buoys were visible and appeared to be in good condition and functional.

Three derelict boats were observed to be anchored in Willamette Cove. None appeared to be anchored on the ACB shoreline of Willamette cove. The tent observed along the Willamette Cover shoreline during the last quarterly inspection was no longer present. No trash, dump sites, or homeless encampments were observed.

The September 2017 shoreline ACB repairs continue to appear to be in good condition and will continue to be monitored throughout the year. Patches of river rock were present along the lower edge of the shoreline along the riparian area. Some small erosional depressions were observed at seams along the TRM during the last site inspection. Along the northern edge of the TRM along the dirt path from the cap area to the shoreline, an erosional depression was observed beneath the edge of the TRM. The area was flagged by Sarah Miller as deep enough to warrant placement of additional material (See Photo 1 and 2).

No stormwater discharge was observed from the outfall during the site inspection. The outfall is in good condition. Vegetation is growing between the rock armoring near the outfall and may need to be pruned in the future. No change to the outfall armoring since the last inspection were observed. No repairs are planned and the armoring will be monitored during the rainy season for signs of additional scouring or erosion.

The site inspection occurred at a river stage where personnel were able to walk out onto the tidal mud flats. A large tire (approximately 4 feet in diameter (Photo 3) was observed along with small bits of trash deposited by the river.

No ebullition was observed from the organoclay layers in Willamette Cove or the Willamette River.

A brush fire in August 2018 burned approximately one acre in the riparian area. Groundcover in the area has recovered with grasses and some noxious weeds present. Larger trees and shrubs show signs of recovery with new leaf development. Charred limbs are still observable on brush and small trees.

Vegetation in the riparian area did not show signs of drought stress however a watering event was in the process of being coordinated when a series of precipitation events occurred in September eliminating the need for a watering event.

Upland Inspection

The following items were inspected during the upland site walk and inspection:

- Site perimeter and fence, and drainage basin.
- Subsurface drainage (manholes) – Manhole SDMH-B
- Soil cap (burrows, erosion, etc.).
- EW-1s and MW-23d area of subsidence.
- Inspected gas vents

The site perimeter fence was intact. No cut locks were found and no animal burrows greater than 6 inches deep requiring filling were observed. A few plastic drums and a stack of plastic buckets are still present in the storage area.

The distance between the inner and outer casing of MW-23d was 2.75 inches, which is the same as recent measurements.

Gas vents G-1, G3, and G-4 were inspected as they were not inspected during the last site inspection as planned. None of the inspection personnel had a map with the exact location of the gas vents and they had to be located in the field. Personnel found gas vents gas vents G-3, G-4, and G-1 at which point heavy rain began to fall so the inspection was concluded. Photos of the gas vents are included as Photo 4 to 7 taken on August 21, 2019, are included to document that vault boxes had additional soil placed to stabilize the vault box (G-2 and G-3) or that the vault box was replaced entirely (G-1 and G-4). Site maps currently list two probes as G-3. Based on the apparent clockwise order the gas vents are labeled as G-1 in the NW corner, G-3 in both the NE and SE corner, and G-4 in the SW corner, it is concluded that the label for G-3 in the NE corner should be G-2 and will be revised accordingly.

Modifications to the PVC well casing on MW-59s were made on August 21, 2019 and were planned to be included during this site inspection. The well was not inspected due to concluding the inspection at the onset of heavy rain. Photos 8 through 11 documents before and after conditions of the well modification.

Action Items and Schedule:	Person Responsible	Deadline
■ Site Maintenance – Replace locks if any found to be cut, fill-in burrows along the fence line, perform shop maintenance (e.g. mouse traps, check equipment).	Kevin Woodhouse	Quarterly
■ Place material under TRM at northern end of riparian area.	Kevin Woodhouse	November 2019
■ Continue to Monitor MW-23d inner/outer casing relationship for movement.	Kevin Woodhouse	Quarterly
■ Monitor burned holes (approximately 3-inch diameter) in the TRM in brush fire area.	Kevin Woodhouse Dan Knapp Tess Lydick	Quarterly
■ Quarterly Site Inspections	Kevin Woodhouse	Quarterly
■ Plan activities for the Five-Year Review groundwater monitoring	Andrew Davidson Kevin Woodhouse	October 2019 through March 2020

Site Activities / Miscellaneous Field Activities Performed Since Last Inspection

- Site features and topographic survey performed between August 13 and 21, 2019, as part of subsidence monitoring program.
- Low-tide monitoring and transducer data download was performed on September 12, 2019.
- Backflow testing on water service performed on September 12, 2019.
- Completed video inspection of the storm sewer on October 4, 2019, as part of the subsidence monitoring program.
- The riparian area watering event scheduled for September 2019 was not performed as significant rainfall occurred during the month eliminating the need for the watering event.
- Maintain storage building and supplies.
- Inspect herbicide application effectiveness on noxious weeds and monitor for growth of noxious weeds.

Deliverables

- Hart Crowser prepared and submitted BAPs on September 19, 2019, to cover O&M and O&F activities from October 1, 2019, through March 31, 2019. Activities to be performed under the O&F task order will be initiated once funding from EPA is received.
- The hard copy DVD of the storm sewer inspection was mailed to the DEQ

Budget Status: Currently at or below anticipated budget**.**

Photos:

Photo 1: TRM at northern end of riparian area displaying signs of sagging.

Photo 2: View of depression under TRM where sand appears to have washed out from under the corner of the mat.

Photo 3: View of tidal mud flats at low tide during and the large, discarded tire that is present.

Photo 4: View of gas vent G-1.

Photo 5: View of gas vent G-2.

Photo 6: View of gas vent G-3.

Photo 7: View of gas vent G-4.

Photo 8: Well cap and casing for MW-59s protruding above the rim of the well box in the perimeter road.

Photo 9: MW-59s well casing after removal of 3 inches using a power drill attached internal PVC pipe cutter.

Photo 10: Well casing sitting below the rim of the well box after trimming.

Photo 11: Well lid sitting correctly in well box after trimming of MW-59s casing.

Table 2.2
Example Site Visitation Record

Table 2.2
Example Site Visitation Record
McCormick and Baxter Creosoting Company
Portland, Oregon

SITE VISIT LOG

VISITORS AND WORKERS MUST CHECK IN AND OUT

Date	Time IN	a.m./ p.m.?	Time OUT	a.m./ p.m.?	Name	Name of Company, Agency, or Organization	Comment (Purpose of Visit, etc.)
3/18/19	1	pm	3:30	pm	Sarah Miller	DEQ	Site Visit
					Kevin Parrett	↓	↓
					Cheyenne Chapman		
					Erin McDonald	↓	
					Annie Christopher	EPA	
					Hunter Young	EPA	
					Jim Ravelli	U of P	
					David Blount	U of P attorney	
					Jeremy Davis	Landau	
					Kent Wiken	Landau	
↓	↓	↓	↓	↓	Miranda Maupin	SKeo	↓
3/25/19	0930	am	4:42	pm	Dan Knapp	Hart Crowser	Site Maintenance
"	"	"	"	"	Tess Lydick	Hart Crower	" "

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SITE VISIT LOG

VISITORS AND WORKERS MUST CHECK IN AND OUT

Date	Time IN	a.m./ p.m.?	Time OUT	a.m./ p.m.?	Name	Name of Company, Agency, or Organization	Comment (Purpose of Visit, etc.)
4/3/19	9:30	am	11:30	am	Sarah Miller	DEQ	Site Inspection
↓	↓	↓	↓	↓	Rick Ernst	Hart Crowser	↓
					Kaylan Smyth	↓	
					Tess Lydick	↓	
					Erin Hughes	GSI	
↓	↓	↓	↓	↓	Andrew Davidson	GSI	↓
4/11/19	10 am	am	1:00	PM	Sarah Miller	DEQ	Site Visit
↓	↓	↓	↓	↓	Kevin Parrett	↓	↓
					Cheryl Grabham	↓	
					Nina Deconcini	↓	
					Jim Ravelli	U of P	
					Fr. Mark Poorman	↓	
					Scott LeyKam	↓	
↓	↓	↓	↓	↓	Kat West	Skeo	↓

VISITORS AND WORKERS MUST CHECK IN AND OUT

Date	Time IN	a.m./ p.m.?	Time OUT	a.m./ p.m.?	Name	Name of Company, Agency, or Organization	Comment (Purpose of Visit, etc.)
5/16/19	9:00	AM	2:30	PM	Kaylan Smyth	HC	Maintenance & Veg Inspection
5/16/19	9:00	AM	1:30	PM	Tim Walters	HC	" "
5/28/19	13:00				Sarah Miller	DEQ	
5/29/19	1300	PM	1500	PM	Kent Wilken	Landau Assoc	Site Work
5:29	1300	PM	1500	PM	Chelsea McLarty	Walker Macy	"
5:29	1300	PM	1500	PM	Nathan Kaplan	W/M	" "
5/29/19	13:00	PM	15:00	PM	David Johnson	Landau Assoc.	" "
5/29/19	13	"	"	"	Kevin Parrett	DEQ	
6/5/19	0930	—	1936	—	Kevin Woodhouse	HC	Site Work
↓	↓	—	1936	—	Kaylan Smith	HC	" "
↓	↓	—	1936	—	Sarah Miller	DEQ	" "
6/5/19	1200	PM	1700	PM	Jim + Tess	HC	Low tide
6/5/19	1200	PM	1700	PM	Amaral	Amaral Services	Vegetation
7/8/19	9:30am		11:15		Sarah Miller	DEQ	Site Visit Quarterly
↓	↓		↓		Kevin Woodhouse	HC	Quarterly Site Visit
↓	↓		↓		Andrew Davidson	GSI	"

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Date	Time IN	a.m./ p.m.?	Time OUT	a.m./ p.m.?	Name	Name of Company, Agency, or Organization	Comment (Purpose of Visit, etc.)
8/13	0800				Kevin Woodhouse	Hart Crowser	
8/13	7:00	AM			MATT KIDDER	WESTLAKE	
8/13	9:00	AM			TYLER RATCLIFFE	WESTLAKE	
8/15	7:00	AM			TYLER RATCLIFFE	WESTLAKE	
8/15	7:00	AM			MATT KIDDER	WESTLAKE	
8/16	7:00	AM			MATT KIDDER	"	
8/~~20~~	7:00	AM			TYLER RATCLIFFE	"	
8/20	8:00	AM			MATT KIDDER	"	
8/20	"	"			TYLER RATCLIFFE	"	
9/12/19	0900	AM	1740	PM	Kevin Woodhouse	~~HCA~~ HCI	low tide monitoring
9/12/19	0900	AM	1745	PM	Daniel Knapp	Hart Crowser	"
9/12	900	AM	1745	PM	Tess Lydick	" "	" "
10/4/19	0730				Kevin Woodhouse	Hart Crowser	Sewer inspection
10/4/19	7:30	AM	12:00	PM	ANNIE FERRIS	BRAVO ENVIRONMENTAL	
10-4-19	0730	Am	12:00	PM	Josh Vasey	BRAVO	STORM INSPECTION
11/1/19	1045	AM	11:30	AM	Daniel Knapp	Hart Crowser	Maintenance/Security

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APPENDIX C
Photographic Log – Vegetation Observations

Photograph C1: Earthen cap and drainage swale in the foreground with the impermeable cap in the background. Taken looking south from Photograph Station 1 comparing baseline and current conditions. (Left - June 2011, Right – June 2014)

Photograph C2 Tree and shrub plantings on the earthen cap. Taken looking southeast from Photograph Station 2 (May 2019).

Photograph C3: Tree and shrub plantings on the earthen cap are healthy and spreading. Taken from Photograph Station 2 looking southeast (October 2012).

Photograph C4: Tree and shrub plantings on the earthen cap are healthy and spreading. Taken from Photograph Station 2 looking southeast (May 2019).

Photograph C5: Eastern edge of the earthen cap with perimeter road in foreground. Taken from Photograph Station 3 looking west (October 2012).

Photograph C6: Eastern edge of the earthen cap with perimeter road in foreground. Taken from Photograph Station 3 looking west (May 2019).

Photograph C7: Stormwater pond dominated by willow and alder. Taken from Photograph Station 4 looking northeast (October 2012).

Photograph C8: Stormwater pond dominated by willow and alder. Taken from Photograph Station 4 looking northeast (May 2019).

Photograph C9: Willow plantings on the earthen cap. Taken from Photograph Station 5 looking northeast (October 2012).

Photograph C10: Willow plantings on the earthen cap. Taken from Photograph Station 5 looking northeast (May 2019).

Photograph C11: Impermeable cap dominated by grasses and herbaceous vegetation in the early summer (left) and fall (right). Taken from Photograph Station 6 looking east (Left – May 2012; right – October 2012).

Photograph C12: Impermeable cap dominated by grasses and herbaceous vegetation in the early summer (left) and fall (right). Taken from Photograph Station 6 looking east (May 2019).

Photograph C13: Vegetation growth within the lower riparian component. Taken from Photograph Station 7 looking south (May 2012).

Photograph C14: Vegetation growth and wood debris within the lower riparian component and along the shoreline. Taken looking southeast from Photograph Station 7 comparing baseline and current conditions (May 2019).

Photograph C15: Upper riparian component with trees, shrubs, and herbaceous plants. Taken from Photograph Station 8 looking southwest (Left – May 2012; right – October 2012).

Photograph C16: Upper riparian component with trees, shrubs, and herbaceous plants. Taken from Photograph Station 8 looking southwest (May 2019).

Photograph C17: Lower riparian component with large wood along the edge. Taken from Photograph Station 9 looking northwest (Left – May 2012; right – October 2012).

Photograph C18: Lower riparian component with large wood along the edge. Taken from Photograph Station 9 looking northwest (May 2019).

Photograph C19: Garry white oak suckering (regenerating) from roots (May 2019).

Photograph C20: Madrone that survived burned (only lower branches died) and big-leaf maple suckering in foreground (May 2019).

Photograph C21: Dead conifer along with regenerating shrubs (May 2019).

Photograph C22: Indigo bush (*Amorpha fruticosa*) B-list invasive (May 2019).

Photograph C23: Shiny-leaf geranium (*Geranium lucidum*) growing in lower riparian area (June 2019).

Photograph C24: Same area after shiny-leaf geranium removal (June 2019).

Photograph C25: Herbicide application (June 2019).

Photograph C26: Many plants or patches were tagged for herbicide application. Foliar spray was used for most species, including tansy (*Tanacetum vulgare*) (June 2019).

Photograph C27: Removal of butterflybush (*Buddleja davidii*) using cutting and stump treatment (June 2019).

Photograph C28: Removal of tree of heaven (*Ailanthus altissima*) using cutting and stump treatment (June 2019).